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Final

Site Specific Work Plan and Sampling and Analysis Plar
Basewide Groundwater Background Investigation Repor

St. Juliens Creek Annex

Chesapeake, Virginia

Prepared for

Department of the Navy
Atlantic Division
Naval Facilities Engineering Command
Norfolk, Virginia

Contract No. N62470-02-D-3052
CTO-0012

September 2003

Prepared by

CH2MHILL

Baker
Environmental, Inc.

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Under the
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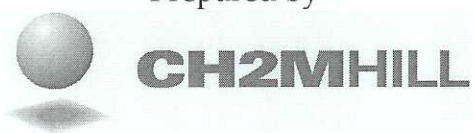

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Prepared by

CH2M HILL

September 2003

Approved by: William J. Friedmann Jr. Date: 09/23/03
William J. Friedmann, Jr., P.G.
Activity Manager

Approved by: Ben Francisco Date: 9/23/03
Ben Francisco
Project Manager

Approved by: for William J. Friedmann Jr. Date: 09/23/03
Donna Caldwell, P.G.
Senior Technical Reviewer

Contents

Tables

Figures (At End of Appropriate Section)

Acronyms and Abbreviations

AOC	Area of Concern
bgs	below ground surface
BOAs	Basic Ordering Agreements
BTAG	Biological Technical Assistance Group
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CLEAN	Comprehensive Long-Term Environmental Action
COC	Chain of Custody
CTO	Contract Task Order
EPIC	Environmental Photographic Interpretation Center
FS	Feasibility Study
FSP	Master Field Sampling Plan
ft	feet, foot
GIS	Geographical Information System
HAS	Hollow Stem Auger
HASP	Master Health and Safety Plan
IAS	Initial Assessment Study
IDWMP	Master Investigation-derived Waste Management Plan
IR	Installation Restoration
IRP	Installation Restoration Program
LANTDIV	Atlantic Division of the Navy
LQAP	Laboratory Quality Assurance Plan
mg/L	milligrams per liter
MPP	Master Project Plan
MS/MD	matrix spike/matrix duplicate
MWP	Master Work Plan
NACIP	Navy Assessment and Control of Installation Pollutants
NAVFACENGOM	Naval Facilities Engineering Command
NFESC	Navy Facility Environmental Service Center
NTR	Navy Technical Representative
PA	Preliminary Assessment
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
OE	Ordnance Explosive

QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
RA	Remedial Action
RAB	Restoration Advisory Board
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	Remedial Investigation
RRR	Relative Risk Ranking
SI	Site Inspection/ Site Investigation
SJCA	St. Juliens Creek Annex
SMP	Site Management Plan
SOP	standard operating procedure
SSA	Site Screening Assessment
SSP	Site Screening Process
SVOC	semivolatile organic compound
SWMU	Solid Waste Unit
TAL	target analyte list
TCL	target compound list
UTL	Upper Tolerance Limit
USEPA	United States Environmental Protection Agency
UXO	unexploded ordnance
VDEQ	Virginia Department of Environmental Quality
VOC	volatile organic compound
VSI	Visual Site Inspection

SECTION 1

1 Introduction

This document describes the field activities that will be completed for the basewide background investigation of groundwater at the St. Juliens Creek Annex (SJCA), Chesapeake, Virginia (Figure 1-1). This work plan has been prepared under the Naval Facilities Engineering Command (NAVFACENGCOM) Atlantic Division (LANTDIV) as part of Navy Contract N62470-95-D-6007, Comprehensive Long-term Environmental Action Navy (CLEAN), District III, Contract Task Order–012. The technical approach is based on the "Final Master Project Plan, Naval Station Norfolk, St. Juliens Creek Annex, Chesapeake, Virginia," dated July 2000.

The base background and environmental setting of SJCA is described in Sections 2 and 3 of the Final Master Project Plan (MPP), prepared by CH2M HILL in July 2000. The previous investigations at St. Juliens Annex indicated that the soils, groundwater, surface water, and sediment have all been impacted by Base activities. However, these investigations have not differentiated the degree to which these constituents were attributed to either site conditions or background conditions associated with naturally occurring constituents and anthropogenic sources. It is essential to distinguish site-related contamination from background levels due to naturally occurring or anthropogenic contamination in order to determine the presence or absence of site-related contamination. Background samples provide baseline measurements to determine the degree of site-related contamination present. The background investigation's purpose is to establish the range in background concentration of Volatile Organic Compounds (VOCs), Semivolatile Organic Compounds (SVOCs), Pesticides/Polychlorinated Biphenols (PCBs), and Metals in the shallow aquifer groundwater throughout the base.

Previous investigations at SJCA are described in Section 2 of this work plan. Section 3 presents the rationale for the sampling tasks and specific sampling locations. Section 4 describes the technical approach to sampling tasks. Section 5 presents general information regarding project management and staff organization, and Section 6 presents the schedule to complete these tasks.

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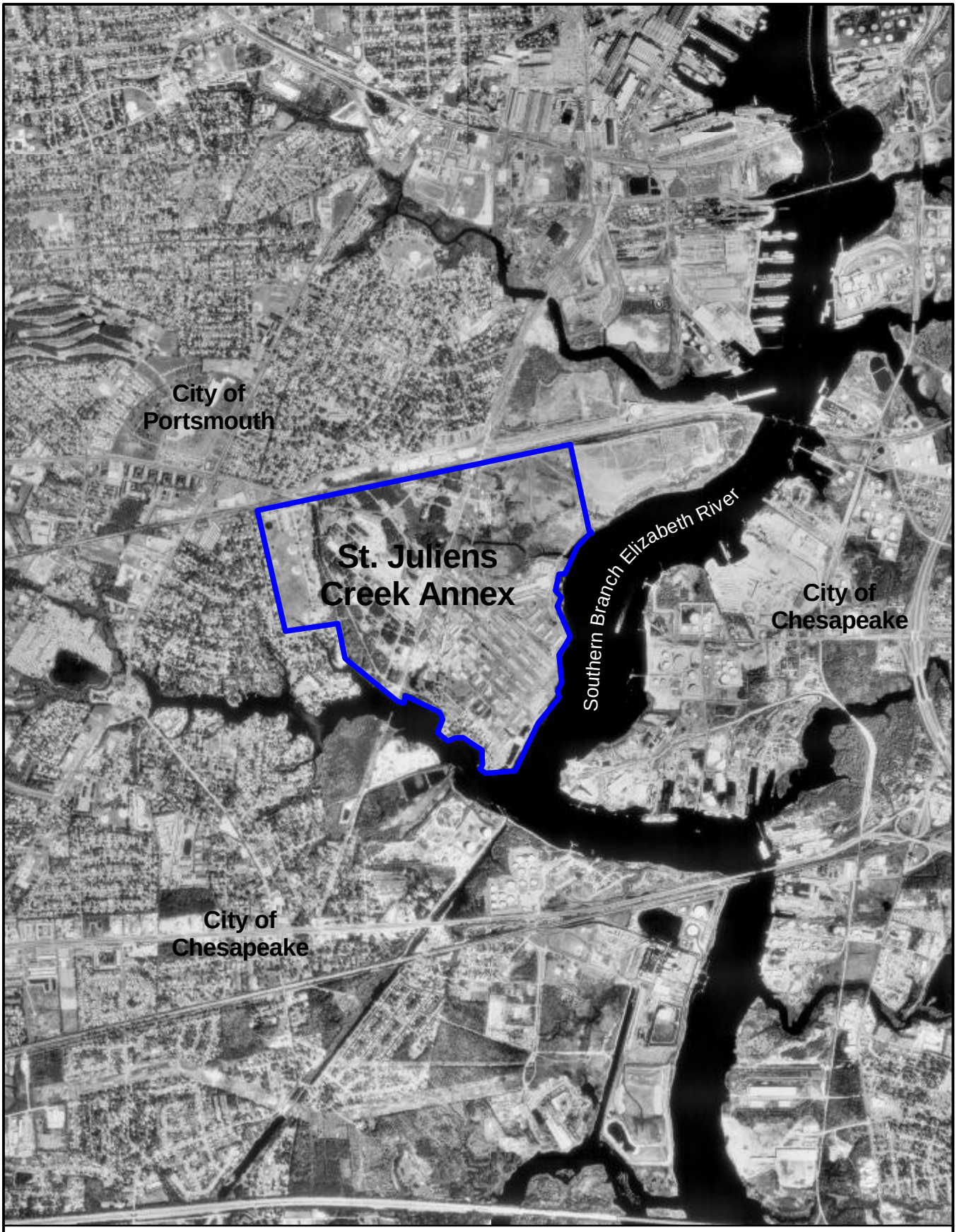

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St. Juliens Creek Annex

N

0 2000 4000 Feet

Figure 1-1
Location of St. Juliens Creek Annex
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

SECTION 2

2 Previous Investigations

Various basewide and site-specific studies and investigations have been completed at SJCA since 1981. The following sections provide a summary of the significant studies conducted to date at SJCA.

2.1 Previous Basewide Studies and Investigations

Previous basewide investigations completed through the Installation Restoration Program (IRP) include the Initial Assessment Study (IAS), dated August 1981 and a Relative Risk Ranking (RRR) System Data Collection Report, dated April 1996. In addition, USEPA Region III conducted two assessments at the Annex: a Preliminary Assessment (PA) in 1983, and a Phase II RCRA Facility Assessment (RFA) in March 1989.

2.1.1 Initial Assessment Study (IAS) 1981

In 1981, The US Navy conducted the IAS as part of the Naval Assessment and Control of Installation Pollutants (NACIP) Program. The purpose was to identify and assess sites that posed a potential threat to human health or the environment because of contamination from past handling of, and operations involving, hazardous materials. The study's results revealed that low-level concentrations of ordnance materials existed throughout the facility. However, the identified sites were determined to not pose a threat to human health and the environment, so no confirmation study was conducted. No sampling was conducted as part of the study.

2.1.2 Preliminary Assessment (PA), 1983

NUS Corporation, Superfund Division (NUS), conducted a PA at seven sites at the facility, including—Cross and Mine (Solid Waste Management Unit [SWMU] #9); Building 249 (SWMU #13); Dump A (SWMU #1); Dump B (SWMU #2); Dump B Incinerator (SWMU #3); Dump C (SWMU #5); and Dump D (SWMU #6). No sampling was conducted as part of the PA, but each site was monitored for VOCs and radiation. The PA report stated that there were no significant signs of contamination at the sites evaluated; however, various facility locations were contaminated with low-level residues of pesticides and herbicides.

2.1.3 Phase II RCRA Facility Assessment (RFA), 1989

A.T. Kearney, Inc. and K.W. Brown & Associates, Inc. prepared a Phase II RFA that included a preliminary review of all available relevant documents and a visual site inspection (VSI), including 34 SWMUs and Areas of Concern (AOCs), eleven of which were recommended for RCRA Facility Investigation (RFIs). No sampling was conducted during the RFA.

2.1.4 Relative Risk Ranking (RRR) System Data Collection Report, 1996

In April 1996, CH2M HILL submitted to the Department of the Navy an RRR System Data Collection Report for SJCA that contained results from sampling conducted at 21 sites at the

Annex where no sampling data had previously been available. The goal of this effort was to gather data for the Navy to perform assessments of the sites using the Navy's RRR System.

2.1.5 Environmental Photographic Interpretation Center (EPIC) Study, 1999

Twelve potential AOCs were identified for investigation during the joint United States Environmental Protection Agency (USEPA), VDEQ, and Navy review of historical aerial photography (EPIC Study) of the facility in June 1999. In November of that year, a work-in–progress/site visit with representatives of the Navy, CDM Federal, VDEQ, and the USEPA-Biological Technical Assistance Group (BTAG) was conducted to evaluate the 12 "EPIC AOC" locations, and review current and past conditions (based on EPIC photographs) to determine if sampling was warranted at any of these EPIC AOCs. In addition, the group reviewed site conditions as well as historical photography of the IRP sites to be included in the Site Screening Assessment (SSA) and those sites designated for Site Investigations. The Navy, USEPA, and VDEQ conducted an additional site visit on February 2, 2000 to confirm this determination. Descriptive information on these EPIC AOC sites can be found in the Site Management Plan.

2.2 Previous Background Sampling

The purpose of the "Final Background Investigation Report" of October 2001 was to establish background concentrations of metals, pesticides, and polynuclear aromatic hydrocarbons (PAHs) in surface and subsurface soil and groundwater for comparison to Installation Restoration (IR) Program site data to better identify release-related constituents of concern.

2.2.1 Soil

A total of 50 surface (0 to 6 in. below ground surface [bgs]) and 50 subsurface soil (1 to 3 ft bgs) samples were collected. The background soil data were statistically evaluated to identify comparable data sets with respect to soil type. Soil types at the Base include Minden-Tetotum, Dragston-Augusta, Bohicket, Urban-Udorthents, and Dredge Fill. Analytical results of background soil samples showed that pesticides and PAHs are present in soils, reflective of potential anthropogenic influence on soil quality. For metals, arsenic consistently exceeded residential risk-based concentrations (RBCs) in both surface and subsurface sample and occasionally exceeded the industrial RBC. Iron exceeded the residential RBC in surface and subsurface samples. One pesticide (4,4-DDE) in one sample exceeded the residential RBC; however, it was detected in several soil samples. The highest concentration and greatest frequency of detection of the PAHs, in both surface and subsurface samples, is in dredge-fill soils. The PAH benzo(a)pyrene, benzo(b)fluoranthracene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene exceeded the residential RBC in several samples. Upper Tolerance Limits (UTLs) and central tendency statistics were established for the soil in appropriate subgroups (soil type/sample depth) for use in comparison with IR site data.

2.2.2 Groundwater

Groundwater samples were analyzed for the full suite of Target Compound List (TCL) organic and Target Analyte List (TAL) metals (total and dissolved). In order to establish

background groundwater quality, samples were collected from four water table aquifer (Columbia Aquifer) monitoring wells and three Yorktown Aquifer background wells. The previous background groundwater samples showed that they were generally of high quality compared to applicable water quality standards and consistent with the Columbia Aquifer groundwater quality characteristics. Analytes detected that exceeded the potentially applicable water quality standards or risk-based guidance concentration were the metals arsenic, iron, and manganese. In addition, four organic compounds were detected in groundwater, including: acetone, bis(2-ethylhexyl) phthalate, trichloroethene, and cis-1,1 dichloroethene. However, acetone and bis(2-ethylhexyl) phthalate are common laboratory contaminants and trichloroethene and cis-1,1 dichloroethene were only detected in trace concentrations at one sampling location. Sample results from these shallow monitoring wells are presented in Table 2-1.

Previous groundwater sampling data from monitoring well SJS03-MW01S will also be included in this background investigation. This monitoring well is installed in dredge-fill soils located in the base's northeastern corner, as a Site 3 site-specific upgradient sample location. Although constructed as a site-specific upgradient well along the northern boundary of the Base, SJS03-MW01S reflects background groundwater quality and is considered comparable to existing background wells SJSBK-MW01S through SJSBK-MW04S. Table 2-2 provides the analytical results from samples collected at SJS03-MW01S in 1999. Analytes detected which exceeded the potentially applicable water quality standards were the metals arsenic, iron, and manganese. In addition, only two organic compounds, acenaphthene and bis(2-ethylhexyl) phthalate, were detected within this groundwater sample.

Table 2-1
Constituents Detected in Groundwater During Previous Background Investigation in 1999
St. Juliens Creek Annex, Chesapeake, Virginia

Station ID	SJSBK-MW1S		SJSBK-MW2S	SJSBK-MW3S	SJSBK-MW4S
Sample ID	MW1S-001	MW1S-001P	MW2S-001	MW3S-001	MW4S-001
Sample Date	05/23/99	05/23/99	05/23/99	05/23/99	05/23/99
Chemical Name					
Volatile Organic Compounds (UG/L)					
Acetone	5 U	5 U	5 U	5 U	30.5
Trichloroethene	0.8 J	0.8 J	1 U	1 U	1 U
cis-1,2-Dichloroethene	0.2 J	0.2 J	1 U	1 U	1 U
Semi-volatile Organic Compounds (UG/L)					
bis(2-Ethylhexyl)phthalate	12 U	11 U	11 U	11 U	11 U
Total Metals (UG/L)					
Aluminum	357	797	181 J	184 J	207
Arsenic	2 U	2 U	2 U	2 U	2 J
Barium	26.1 J	21.5 J	63.5 J	63.1 J	58.6 J
Beryllium	0.27 J	0.27 J	0.1 U	0.1 U	0.1 U
Calcium	27,900	23,700	21,300	33,100	142,000
Cobalt	13.9 J	11.7 J	8.5 J	5.1 J	0.84 J
Iron	18,000	15,800	374	715	8,620
Lead	1 U	1 U	1.9 J	1 U	1.1 J
Magnesium	19,600	17,100	5,990	4,860 J	14,900
Manganese	912	796	246	121	384
Nickel	15.1 J	12.4 J	7.9 J	7.6 J	2.7 J
Potassium	5,010	4,760 J	1,620 J	1,650 J	3,830 J
Sodium	52,700	47,000	34,200	18,600	53,900
Vanadium	0.79 J	0.6 U	1 J	0.79 J	0.91 J
Zinc	89.7	77.4	44.7	9.5 J	43.7
Dissolved Metals (UG/L)					
Aluminum	399	297	38.2 U	38.2 U	69.9 J
Arsenic	2 U	2 U	2 U	2.1 J	2.2 J
Barium	24 J	23.3 J	61.7 J	63.2 J	53.2 J
Beryllium	0.31 J	0.29 J	0.1 U	0.1 U	0.1 U
Calcium	30,000	30,100	21,400	34,800	141,000
Chromium	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U
Cobalt	14.4 J	13.6 J	8 J	4.6 J	0.5 U
Iron	21,100	21,200	65 J	110	8,780
Lead	2.1 J	1.1 J	1.1 J	1 U	1 U
Magnesium	22,400	22,400	5,780	4,890 J	13,700
Manganese	1,040	1,050	234	120	377
Nickel	14.3 J	13.5 J	6.9 J	7.2 J	2.2 J
Potassium	5,620	5,550	1,600 J	1,610 J	3,910 J
Sodium	57,700	57,800	33,500	18,400	49,100
Zinc	109	95.1	45.4	9.1 J	25.8
Wet Chemistry (MG/L)					
Phosphorus	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U

Notes:
Detected concentration
J - Analyte present, reported value may not be accurate or precise
U - Not detected

Table 2-2
Constituents Detected in Groundwater at Site 3 in 1999
St. Juliens Creek Annex
Chesapeake, Virginia

Station ID	**SJS03-MW01S**
Sample ID	SJS03-GW1S-003
Sample Date	05/23/99
Chemical Name	
VOCs (UG/L)	
Acetone	NA
Ethylbenzene	1 U
Toluene	1 U
Xylene, total	1 U
SVOCs (UG/L)	
2-Methylnaphthalene	11 U
4-Methylphenol	11 U
Acenaphthene	3 J
Carbazole	11 U
Dibenzofuran	11 U
Fluoranthene	11 U
Fluorene	11 U
Naphthalene	11 U
Phenanthrene	11 U
Phenol	11 U
bis(2-Ethylhexyl)phthalate	1 J
Pest/PCBs (UG/L)	
Heptachlor	0.0520 U
Total Metals (UG/L)	
Aluminum	395
Antimony	2.70 U
Arsenic	3.40 J
Barium	23.1 J
Beryllium	0.100 U
Cadmium	0.420 J
Calcium	141,000
Chromium	3.20 J
Cobalt	2.30 J
Copper	5.20 B
Iron	34,600
Lead	2.30 J
Magnesium	31,600
Manganese	1,770
Nickel	4 J
Potassium	27,100
Selenium	2.60 U
Silver	0.900 U
Sodium	132,000
Thallium	3.20 U
Vanadium	1.5 J
Zinc	241

SECTION 3

Sampling Rationale

This section presents the rationale and sampling locations for the background groundwater investigation at SJCA.

3.1 Sampling Rationale

The information collected for this background investigation will be used along with the previous groundwater background samples as documented in the 2001 Background Investigation Report. The statistical analysis of the background sampling data will be evaluated to establish the range of anthropogenic and naturally occurring concentrations of constituents. It is important to distinguish site-related contamination from background levels due to naturally occurring (those chemicals expected at a site in the absence of human influence) or anthropogenic (chemicals that are present in the environment due to man-made, non-site sources) contamination in order to determine the presence or absence of site-related contamination. Background samples provide baseline measurements to determine the degree of site-related contamination present. Background samples are collected from areas that have not been exposed to the sources of onsite contamination.

The specific goal of the sampling effort at SJCA is to establish background concentrations of, SVOCs, metals, and pesticides in shallow groundwater (Columbia aquifer) for use of comparison to IR Program site data to better identify release-related constituents of concern. These are the parameters most commonly found to occur naturally or from anthropogenic sources. VOCs and PCBs are not considered naturally occurring or anthropogenic but are included as part of a full suite of analyses to ensure that the samples reflect background conditions.

The deep groundwater (Yorktown aquifer) will not be evaluated as part of this investigation because there are no deep groundwater supply wells nearby. In addition, the previous investigations at the site have not identified contamination in the deep aquifer and there is a clay confining unit that separates the two aquifers. However, if future investigations indicate that there is contamination in the deep aquifer, background concentrations for the deep groundwater will be determined as part of the IR program.

The information collected during this background sampling event will be used to supplement the information collected in remedial investigations (RI) and risk assessments (RA) and aid in determining if additional site investigations, institutional controls, or remediation is required.

3.2 Sampling Locations

In order to generate a data set sufficient to determine the background concentrations of constituents in the shallow groundwater at SJCA, 11 groundwater samples will be collected and analyzed for Low Concentration VOCs, Low Concentration SVOCs, Pesticides/PCBs, Total Metals, and Dissolved Metals. Samples will be collected from the four existing shallow

background wells (SJSBK-MW1S through SJSBK-MW4S), six new background wells (SJSBK-MW5S through SJSBK-MW10S), and one existing site upgradient well (SJS03-MW01S).

The proposed new monitoring well locations were selected based on the following criteria:

- Previous land use
- Distance from known IR Sites
- Soil type (dredge fill vs. native soil)
- Current land use
- Access and overhead clearance

The locations of the existing and proposed monitoring wells are shown in Figure 3-1. Existing monitoring wells are limited to IR site areas; therefore limited groundwater elevation data are available with which to determine the groundwater flow contours throughout the Base. However, general groundwater flow (Figure 3-1) can be estimated based upon the existing data and the interpreted influence of surface water features.

Groundwater in the northeastern corner of the Base flows south toward Blows Creek. Therefore, three new monitoring wells will be installed along the northern boundary of the facility, upgradient of known IR sites. In addition, one existing upgradient well (SJS03-MW01S) in the northeastern area will be sampled and incorporated into the background data set. St. Juliens Creek and Blows Creek influence groundwater in the northwestern corner of the Base. Groundwater on the southwestern border of the Base tends to flow west towards St. Juliens Creek while groundwater towards the northwestern portion of the base flows east towards Blows Creek. Three new monitoring wells are proposed in the northwestern corner and along the western border of the facility, upgradient of known IR sites.

Mr. Bill Friedmann of CH2M HILL conducted verification of the locations during a site visit on April 22, 2003. The final sample locations will be determined in the field by the onsite geologist following utility clearance. The Navy and regulators will be notified prior to any significant proposed changes in sample locations based on site conditions and professional judgments by the site geologist. The analytical data collected during previous investigations were considered during the planning phase of the investigation, and factored into the interpretation of site conditions. The locations selected to be representative of background levels at SJCA were agreed upon by the Navy, USEPA, and VDEQ on April 15, 2003, during the development of this Background Groundwater Investigation Work Plan.

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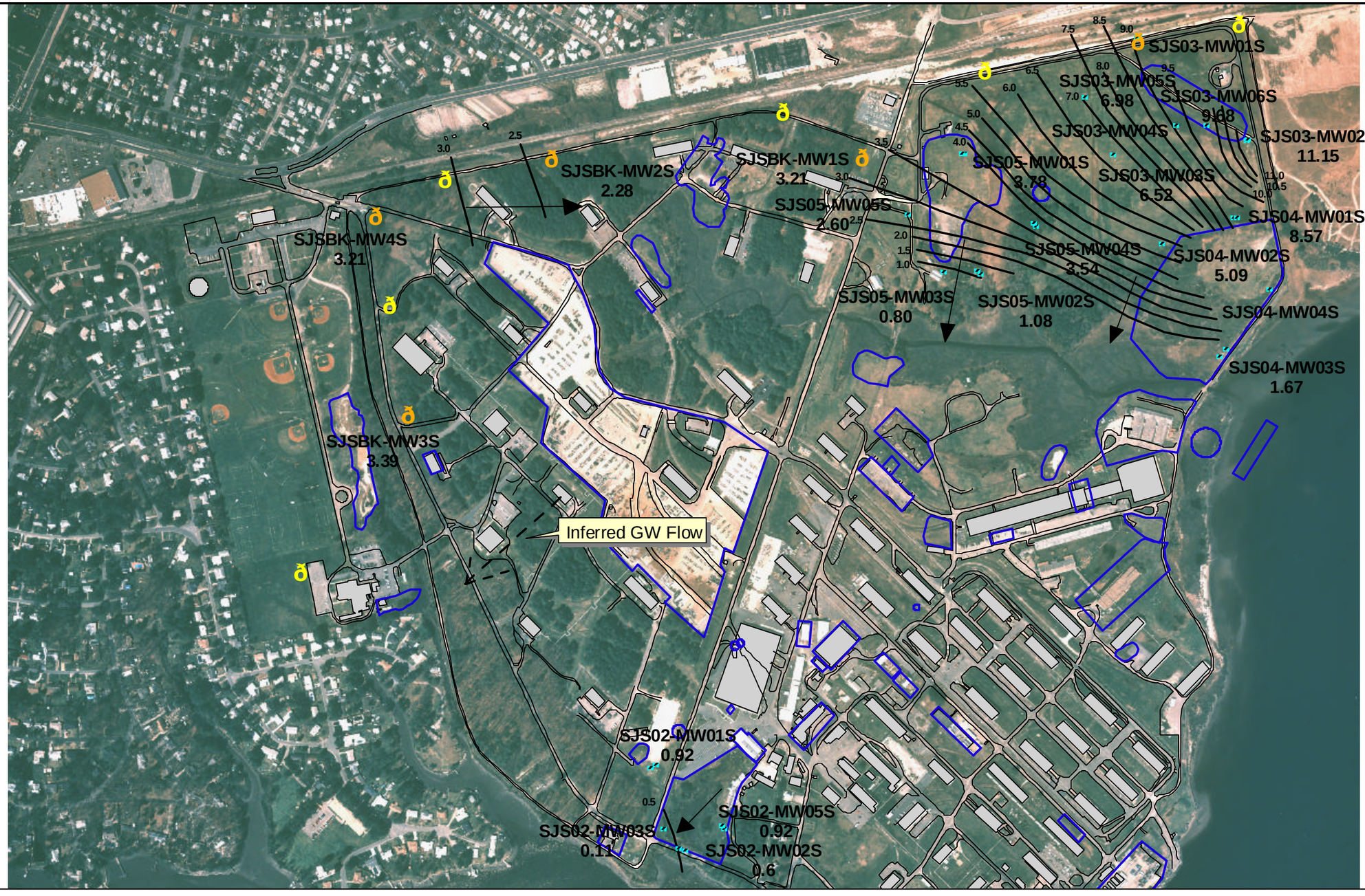

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- Proposed Background Groundwater Sampling Locations
- Background Groundwater Sampling Locations
- Monitoring Wells
- 2003 Sites

Contour Interval = 0.5'

N

0 300 600 Feet

Figure 3-1
Proposed Background Shallow Groundwater Locations and Contour Map
St. Juliens Creek Annex
Chesapeake, Virginia

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SECTION 4

4 Technical Approach and Investigation Procedures

This section presents the technical approach in performing sampling activities for the background groundwater investigation at SJCA. The Master Project Plan (MPP) for SJCA addresses the protocols and standard operating procedures (SOPs) to be used for all investigations at SJCA (CDM, 2000). The SJCA MPP consists of the Master Work Plan (MWP), Master Field Sampling Plan (MFSP), the Master Quality Assurance Project Plan (MQAPP), the Master Investigation-Derived Waste Management Plan (MIDWMP), and the Master Health and Safety Plan (MHSP). Preparation of site-specific plans is simplified through reference to the MPP documents. This WP provides site-specific details for the investigation and references the MPP as appropriate. Checklists and a health and safety plan to address site-specific details relevant to the MWP, MFSP, MQAPP, MIDWMP, and MHSP are provided in Appendix A.

4.1 Field Investigation

The field investigation activities involve efforts related to fieldwork support, field investigation and sampling activities, sample shipping and chain-of custody, sample designation, field team performance and system audits, surveying, unexploded ordnance (UXO) support, and management of investigation-derived waste (IDW).

4.1.1 Fieldwork Support

Fieldwork support includes subcontractor procurement, mobilization, utility clearance, and UXO support as described in the following subsections.

4.1.1.1 Subcontractor Procurement

As part of the initial field mobilization to SJCA, CH2M HILL will procure a Hollow Stem Auger (HSA) drilling company, utility clearance, unexploded ordnance (UXO) clearance, analytical laboratory, and data validation services. A licensed surveyor will also be mobilized following the installation of the groundwater monitoring wells. The subcontracted analytical laboratory will meet Naval Facilities Environmental Service Center (NFESC) Level D quality control.

The firms providing these services shall be procured using the Basic Ordering Agreements (BOAs) under the CLEAN III contract. In cases where BOAs are not in place for services required, CH2M HILL would provide subcontractor services in accordance with procedures that will be established between CH2M HILL's contract administrator and LANTDIV's contracting officer.

4.1.1.2 Mobilization/Demobilization

Mobilization includes procurement of necessary field equipment, and initial transport to the site. Equipment and supplies will be brought to the site when the CH2M HILL field team mobilizes for field activities. Demobilization activities include general site restoration prior to the return transport of field equipment and crew. In an effort to reduce mobilization costs, the CTO 012—Background Investigation will be conducted concurrently with the fieldwork for the CTO 014—Site Investigation at Various Sites.

4.1.1.3 Utility Clearance

Utility clearances will be performed prior to the start of any subsurface investigation activities at the site. CH2M HILL will coordinate subsurface utility clearances with Miss Utility through the SJCA. CH2M HILL will be responsible for ensuring that all appropriate contacts have been made with base personnel and that clearances have been given for proposed monitoring well locations, including marking of utilities near the areas of proposed monitoring well locations, prior to the initiation of field operations.

This section includes a description of the anticipated field activities for the background study. The number of samples to be collected and the analysis to be completed from each were agreed upon by the Navy, USEPA, and VDEQ during the development of this Groundwater Background Investigation Work Plan.

4.1.1.4 UXO Support

Due to the nature of investigative work being conducted as part of this WP, ordnance explosive (OE) or UXO avoidance practices will be implemented during installation of the monitoring wells. The UXO subcontractor will be Navy approved and provide a sitespecific Health and Safety Plan. All CH2M HILL employees and subcontractors will be responsible for following the CH2M HILL Standard of Practices **HSE-35 (Drilling)** and **91 (Ordnance Explosives)** as provided in Appendix C.

4.1.2 Field Sampling Activities

4.1.2.1 Groundwater Monitoring Well Installation

Monitoring wells will be installed at six locations (Figure 3-1). Each monitoring well will be constructed with 2-in. nominal-diameter Schedule 40 PVC screen and riser. Monitoring well screens will be machine slotted 0.010-in., 10 ft in length. The top of the well screens will be placed at the depth of first-encountered groundwater (approximately 5 ft bgs). A silica filter pack will be placed around the annular space of the well screen from the bottom of the boring extending to a depth of 2 ft above the top of the screen. A 2-ft bentonite layer will be placed above the top of the sand pack. After the bentonite has been hydrated, a cement-bentonite grout will be placed in the remaining annular space. The monitoring wells will be completed flush to ground surface with a watertight steel cover. A locking watertight cap will be placed on the PVC pipe and the wells clearly marked.

The newly installed wells will be thoroughly developed before sampling and existing wells may need to be redeveloped. Development before sampling will require the removal of water from each well using a submersible pump, or bladder pump. It will consist of removing at least three well volumes of water, plus the amount of water added during the installation process (for newly installed wells). Development will continue until the

groundwater parameters and turbidity stabilize. Development information, including turbidity, pH, specific conductivity, and temperature, will be recorded in the field logbook. The applicable Standard Operating Procedures (SOPs) for the installation of monitoring wells from Master Project Plan are included with the Field Sampling Plan checklist (Appendix A). Additional instruction on monitoring well development is provided in the Section 2.9 in the FSP.

4.1.2.2 Groundwater Sampling

Eleven shallow groundwater monitoring wells will be sampled for VOCs, SVOCs, pesticides/PCBS, and total and dissolved metals. The number of samples and analyses for groundwater samples is summarized in Table 4-1. QA/QC samples are included in Table 4-2. Groundwater samples will be collected using low-flow purging and sampling techniques. It is anticipated that a peristaltic pump will be used for groundwater sampling. The applicable SOPs for the collection of groundwater samples are presented in the Master Project Plans and are included with the Field Sampling Plan checklist. Groundwater samples will be collected by placing the intake within the middle of the monitoring well screen interval. For the collection of water samples for VOC analysis, the bottles will be filled so as to minimize aeration and filled completely and capped to prevent the entrapment of any air bubbles in the vial. Table 4-2 lists the number of samples including field related QC checks. Table 4-3 presents the sample containers for each analysis.

TABLE 4-1
Groundwater Background Investigation Sample Summary
St. Juliens Creek Annex, Chesapeake, Virginia

Media	Number of Samples	Analyses	Methodology
Groundwater	11	Low-Concentration VOCs	USEPA CLP OLC03.2 for low -concentration VOCs
	11	Low-Concentration SVOCs	USEPA CLP OLC03 for low -concentration SVOCs
	11	TCL Pesticides / PCBs	US EPA CLP OLM03 or latest version for pesticides
	11	TAL Metals (total and dissolved)	USEPA CLP Inorganics SOW IML04

Notes:

TAL = Target Analyte List

TCL = Target Compound List

CLP = Contract Laboratory Program (most recent version)

TABLE 4-2
Groundwater Background Investigation—Groundwater Samples
St. Juliens Creek Annex, Chesapeake, Virginia

Parameter	Method	No. of Samples	Trip Blanks	Filtration Blanks	Field Blanks	Field Duplicates	Matrix Spike/ Duplicate	Total Number of Samples
Groundwater Samples								
TCL Volatile Organics (Low Concentration)	CLP OLC03.2	11	3	0	3	2	NA	19
TCL Semi Volatile Organics (Low Concentration)	CLP OLC03	11	0	0	3	2	NA	16
TCL Pesticides/PCBs	CLP OLC03 or latest version	11	0	0	3	2	1	17
TAL Metals (dissolved)	CLP ILM04	11	0	1	0	2	1	15
TAL Metals (total)	CLP IML04	11	0	0	1	2	1	15

Notes:

NA = Not Applicable

Assumptions regarding rate of sample collection:

1. Three days are required to collect groundwater samples
2. Trip blanks – one per cooler containing VOC samples
3. Filtration Blank – One per 20 samples for dissolved metals only.
4. Equipment Rinsate blanks – No equipment blanks will be collected since sampling equipment is disposable.
5. Field Blanks – one per day for low-concentration analyses by CLP OLC03.
6. Field Duplicates – 1 per every 10 samples per matrix/medium
7. Matrix Spike/Matrix Spike Duplicates – One per 20 samples per matrix (not required for low-concentration analyses by CLP OLC03

TABLE 4-3
Required Containers, Preservatives, and Holding Times for Groundwater Samples
St. Juliens Creek Annex, Chesapeake, Virginia

Parameter	Method	No. of Sample Containers	Sample Containers	Preservative	Holding Time	Volume of Sample Collected
Groundwater Samples						
TCL Volatile Organics (Low Concentration)	CLP OLC03	3	40 ml glass vials w/ teflon-lined cap	HCL to pH < 2 Cool to 4° C	14 Days	Fill completely; no air bubbles
TCL Semi Volatiles Organics (Low Concentration)	CLP OLC03	2	1-liter bottle	Cool to 4 ° C	7 Days	Fill to shoulder
TCL Pesticides/PCBs	CLP OLC03	2	1-liter bottle	Cool to 4 ° C	7 Days	Fill to shoulder
TAL Metals (total and dissolved)	CLP ILM04	2	1-liter polyethylene bottle	HNO_3 to pH <2; Cool to 4 ° C	6 Months (28 Days for Mercury)	Fill to shoulder

4.1.2.3 Groundwater Gauging

To determine groundwater flow direction across the Base, water-level measurements will be collected from all background and site monitoring wells. Groundwater levels will be measured with a water level indicator. The depth from the top of the casing to the groundwater level will be recorded to the nearest 0.01 ft.

4.1.2.4 Sampling Equipment Decontamination

All non-disposable sampling equipment will be decontaminated immediately after each use. The applicable SOPs for the decontamination of personnel and equipment from the Master Project Plan are included with the Field Sampling Plan checklist.

4.1.2.5 Investigation-Derived Waste (IDW)

It is not anticipated that the activities associated with the background investigation of groundwater at St. Juliens will result in the generation of hazardous IDW; therefore, excess soil and groundwater will be placed on the ground unless contaminants are noticeable. If contaminants are visible in soil and/or groundwater, IDW will be containerized in UN-approved 55-gallon drums that will be temporarily stored on site. The IDW will be labeled in accordance with the procedures outlined in the Master Project Plans.

4.1.3 Sample Designation

Sampling locations and samples collected during the background investigation will be assigned unique designations to allow the sampling information and analytical data to be entered into the existing Geographic Information System (GIS) Data Management system. The following sections describe the sample designation specifications.

4.1.3.1 Specifications for Field Location Data

Field station data is information assigned to a physical location where a sample is collected. For example, a monitoring well that has been installed will require a name to uniquely identify it with respect to other soil boring locations or other types of sampling locations. The station name provides for a key in the database to which any samples collected from that location could be linked to form a relational database.

A listing of the location identification numbers will be maintained by the field team leader, who will be responsible for enforcing the use of the standardized numbering system during all field activities. Each station will be designated by an alphanumeric code that will identify the station's location by facility, site type, site number, station type, and sequential station number. The schema that will be used to identify field station data is documented in outline in Section 3.1 of the Master FSP.

4.1.3.2 Specifications for Analytical Data

Analytical data will be generated through sampling groundwater at SJCA. Each analytical sample collected will be assigned a unique sample identifier. The schema used as a guide for labeling analytical samples in the field is documented below. The format that will be used for electronic deliverables from the analytical laboratory and the data validator is presented in Section 4.3. The following is an example of the designations for background samples to be collected for groundwater:

- **SJ**SBK-MW05S-03C: St. Juliens Creek Annex
- SJ**S**BK-MW05S-03C: Site Type—Site
- SJS**BK**-MW05S-03C: Background Location
- SJSBK-**MW0**5S-03C: Monitoring Well
- SJSBK-MW0**5S**-03C: Station 5; Shallow well
- SJSBK-MW05S-**03**C: Year sample collected
- SJSBK-MW05S-03**C**: Quarter of year (A-first; B-second; C-third, D-forth)

4.1.4 Sample Shipping Procedures

All field sampling activities will be documented through the use of field logs and chain-of-custody procedures, Sample containers will be clean first-quality containers provided by the laboratory. An identification label, indicating the sample number, station number, analysis to be performed, preservative used, date and time of sample collection, and the name of the responsible sampling team member.

After the samples are collected, they will be packed in coolers with bubble and ice for delivery to the laboratory. Chain-of-Custody forms will be taped to the inside of the lid of each cooler. Chain-of Custody forms contain general information about the location of the activity and the members of the sampling team as well as specific information about the type of sample location, number of sample containers from each station, and analyses to be performed. Each time the sample is relinquished or received, the party involved signs the form and notes the time and date.

The coolers used to deliver the samples will be sealed with strapping tape. Evidence tape will be placed across the front and back of each lid to control tampering. The samples will

be delivered to the laboratory at the end of each sampling day of to ensure that holding times are not exceeded.

4.1.5 Field Team Performance and Systems Audits

The project manager or designee will conduct a performance audit as needed during the sampling activities to verify that the proper sampling and documentation procedures presented in the QAPP and the FSP are followed and that subsequent sample data are valid. The audit will focus on the details of the QA program. The audit checklist is the guide for performing audits for field procedures and is shown in Figure 11-1 of the Master QAPP. The audit will evaluate the following:

- Project responsibilities
- Sample-collection and sample-preservation procedures
- Equipment-decontamination procedures
- Field equipment-calibration procedures
- Sample-custody procedures
- Document control
- Sample-identification system
- QC corrective-action procedures

An audit report summarizing results and corrections will be prepared and filed in the project files. Significant variances from established procedures will be reported to the project manager.

4.1.6 Surveying

Groundwater monitoring wells will be surveyed using a licensed surveyor. Each well will be surveyed for both horizontal and vertical control. This includes establishing the elevation reference point for wells at the top of the inner PVC well casing, and a permanent mark designating the elevation point. The ground surface elevation for each well and boring will be established to an accuracy of +/-0.01 ft. Horizontal control will be established to +/- 0.1 ft.

4.2 Sample Analysis and Validation

This task involves efforts related to sample management and data validation. CH2M HILL will be responsible for tracking sample analysis and obtaining results from the laboratory. The analytical data generated during the background investigation field program will be validated by an independent data validation subcontractor according to USEPA standard procedures.

4.2.1 Sample Analysis

All analyses will be conducted at a laboratory that fulfills all requirements of the Navy's quality assurance/quality control (QA/QC) Program Manual and USEPA's Contract Laboratory Program (CLP). A signed certificate of analysis will be provided with each laboratory data package, along with a certificate of compliance certifying that all work was performed in accordance with the applicable federal, state, and local regulations. All analyses will be performed following the highest level of Navy guidance. Analyses will

include the proper ratio of field QC samples recommended by NFESC guidance for the DQOs.

4.2.1.1 Field Quality Control Procedures

Quality control duplicate samples and blanks are used to provide a measure of the internal consistency of the samples and to provide an estimate of the components of variance and the bias in the analytical process. The details with regard to the number and frequency of field QC samples to be collected during the investigation are provided in the Master QAPP and are summarized in Table 10-1and are summarized for this investigation in Table 4-2.

4.2.1.2 Blanks

Blanks provide a measure of cross-contamination sources, decontamination efficiency, and other potential errors that can be introduced from sources other than the sample. ASTM Type II water (reagent free, organic free, and deionized) will be used for blanks. The types of blanks that can be generated during sampling activities include trip blanks, field blanks, equipment rinsate blanks, filtration blanks, and temperature blanks.

One trip blank will be included in each cooler used for the daily shipment of VOC samples. If more than one cooler is sent on a given day, all VOC samples should be placed in one cooler, if possible, to minimize the number of trip blanks needed. The trip blanks will be prepared before each sampling event, shipped or transported to the field with the sampling bottles, and returned unopened for analysis. Trip blanks will indicate if there is contamination during shipment to the field, from storage in the field, or during shipment from the field to the analytical laboratory.

One field blank will be collected per day during the sampling event. Field blanks are used to determine the chemical quality of water used for such procedures as decontamination and blank collection.

All equipment used during this investigation is disposable; therefore there is no need for an equipment blank.

One filtration blank per 20 samples will be collected to determine the influence of the filter on filtered metal samples.

The USEPA has recently requested that a temperature blank be included in each cooler containing samples for CLP analyses so that the laboratory can record the temperature without disturbing the samples. Therefore, a labeled temperature blank will be included in each cooler, but will not be given a sample number nor will it be listed as a sample on the chain of custody (COC) form.

4.2.1.3 Duplicates

Field duplicate samples will be collected at a frequency of 1 per 10 field samples per matrix. The location from which the duplicates are taken will be randomly selected. Each duplicate sample will be split evenly into two sample containers and submitted for analysis as two independent samples.

4.2.1.4 Matrix Spike/Matrix Spike Duplicate

Matrix spike/matrix spike duplicate (MS/MSD) samples will be collected at a frequency of 1 for every 20 field samples collected. Analytical results of these samples indicate the impact the matrix (water, soil, and sediment) has on analyte extraction. MS/MSD samples give an indication of the laboratory's analysis accuracy and precision within the sample matrix. Data validators will use these results to evaluate the accuracy of the analytical data.

4.2.2 Data Validation

Analytical results will be validated by CH2M HILL subcontractors approved by the Navy. Procedures used for the validation process will be in accordance with *Region III Modifications to National Functional Guidelines for Organic Data Review Multi-media, Multi-concentration* (USEPA, September 1994), and *Region III Modifications to Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses* (USEPA, April 1993).

Data that should be qualified will be flagged appropriately. Results for QA/QC samples will be reviewed and the data will be qualified further, if necessary. Finally, the entire data set will be examined for consistency, anomalous results, and reasonableness.

4.2.2.1 Data Qualifiers

The data validation qualifiers, or "flags," used for the background investigation data and a brief interpretation follow.

- Data qualified with a "B" flag by the data validator indicate that the analytes have also been detected in a field, equipment, or trip blank, or in a laboratory QA/QC sample. The concentration of a "B"-qualified result is less than 10 times the concentration of the constituent for an associated QA/QC result. If the sample concentration is less than 10 times the associated blank concentration, the conclusion is that the parameter was not detected. Further discussion of potential sources of blank contamination is provided in Section 5.1.3 below.
- Data qualified with a "J" flag indicate that the values were estimated.
- Data qualified with a "U" indicate that the analyte was not detected and the associated number indicates the approximate sample concentration necessary to be detected.
- Data qualified with a "D" indicate that the result came from a diluted sample.
- Data qualified with a "JD" indicate that the values were estimated and the results came from a diluted run.
- Data qualified with a "UJ" indicate that the analyte was not detected and the quantitation limit may be inaccurate or imprecise.
- Data qualified with a "L" indicate that the analyte was present; however; the reported value may or may be inaccurate or imprecise.

Data qualified with a "K" indicate that the analyte was present; however; the reported value may be biased high and the actual value is expected to be lower.

4.2.2.2 Electronic Deliverable File Format

An offsite laboratory will analyze the background investigation samples and tabulate the results in an electronic format specified by CH2M HILL. The data validator will add data validation qualifiers to the table of analytical results. In addition to a hardcopy data package deliverable, CH2M HILL will receive an electronic file from the data validator in a table format that will facilitate downloading into a database. The format that will be used for electronic deliverables is presented in Table 4-4.

4.3 Data Evaluation

Groundwater samples will be collected, analyzed, and validated during this background investigation to establish background groundwater quality. These results will be evaluated to provide descriptive statistics to quantify the mean and variability of the data.

Summary statistics of the groundwater data for each parameter will be calculated, including common parameters such as the mean, standard deviation, and sample size. Upper tolerance limits (UTLs) will also be calculated as a threshold for determining whether individual concentrations are consistent with the background data. These UTLs will be upper confidence limits of the 95th percentile. Although UTLs do offer one type of comparison between site (investigative) and background concentrations, the definitive test will involve comparisons between background and site means (or medians).

Such comparisons of means (or medians) are termed central tendency comparisons and may use a variety of statistical methods depending on the distribution of the background and site data. The statistical distribution of the data will be determined using the Shapiro-Wilk test for normality. This test determines whether or not the data is normally distributed by comparison of a calculated p-value for normality to a significance level of 0.05. Using the threshold of 0.05 limits the probability that the assumption of normality will be rejected for a set of data (when that data is actually drawn from a normally distributed parent population) to 0.05 (5% of the time). The same method can be applied to log-transformed data to test for lognormality, once again using a significance level of 0.05.

If both the background and site data share the same distributional assumption (e.g. normality or lognormality) then a two-sample t-test will be performed on the data to test whether the site mean exceeds the background mean. If not, then a nonparametric two-sample test, the Wilcoxon Rank Sum test, will be applied. This nonparametric test essentially compares the medians of the background and site populations.

The significance level for these two-sample comparisons is initially projected to be 0.20. This limits the probability that site will be determined to exceed background, when it actually does not, to 0.20 (20% of the time). Using estimates of the mean and standard deviation from initial groundwater background data, the use of a significance level of 0.20 provides an acceptable power of comparison between background and site data. The power of the comparison is the probability that the site will correctly be determined to exceed background when it actually does. Using projected background sample sizes of 11 and 15, a projected site sample size of 4, and a ratio of standard deviation to the mean of 0.8 (typical of the initial background groundwater data), the power of the comparison to resolve a 100% difference between site and background is 0.78 to 0.83. If (after the completed background and site data sets are available) this level of power (0.8) can be achieved with a lower

significance level (e.g. 0.05), such an alternate significance level may be considered for the statistical comparisons.

In addition to the statistical analyses, graphical presentations of the data will be generated as part of the statistical analysis of groundwater data.

TABLE 4-4
Analytical Data Electronic Deliverable
St. Juliens Creek Annex, Chesapeake, Virginia

Field Name	Field Type	Description
Analytical data must be delivered in Microsoft Excel.		
Sample_ID	A25	The CH2M HILL sample ID (taken from the COC).
Sample_Analysis	A9	The analysis performed on the sample. We classify our samples into six main groups: VOA, SVOA, INORG, PEST, WCHEM, and FMETAL (for filtered samples).
Date_Analyzed	D	The date the sample was analyzed.
Date_Received	D	The date the sample was received in the lab.
Date_Collected	D	The date the sample was collected.
Lab_Sample_ID	A15	The lab sample ID.
Dilution_Factor	N5	The dilution factor used, if applicable. Use 1 if not diluted.
SDG_Number	A15	The SDG number.
CAS Number	A6-A2-A1	CAS Number of the compound being analyzed (Note that the CAS number must consist of three number segments of defined length, separated by dashes).
Chem_Name	A45	The compound being analyzed.
Ana_Value	N11	The analytical result.
Std_Qual	A5	The lab qualifiers, if any (e.g., U, UJ, B).
DV_Qual	A5	The data validation qualifier (e.g., J, R).
Units	A10	The unit of the result (e.g., MG/L).
Detect_Limit	N5	The detection limit for the compound.
Method	A15	Analytical method used to analyze the sample fraction.

Notes:

Information under the Field Type column shows the code for representing alphanumeric information (ASCII)

A – Alphanumeric (e.g., A25; field is allowed to have up to 25 characters)

D – Date

N – Number (e.g., N11; field is allowed to have a number up to 11 characters)

4.4 Use of Background Data

The statistical analysis of background data will be used to better identify and assess site-related contamination and for use in the risk management process. Within the CERCLA process, sites are initially addressed in the Site Screening Process (SSP) or Site Investigation (SI) process to determine if a site release has occurred and to qualitatively evaluate site risks. Where a site release is indicated or known to have occurred and the risk present at the site warrants further investigation, sites are addressed in the Remedial Investigation process

and risks are quantitatively evaluated. The approach for using background data focuses on application within these CERCLA processes and is discussed below.

4.4.1 Site Screening or Site Investigation Process

For site data collected as part of the Site Screening/Site Investigation Process, background data can be used to determine if a site release has occurred. This process has multiple steps: 1) qualitative comparison to screening criteria; 2) comparison of maximum site concentrations to background UTLs; 3) risk ratio comparison to EPA-established benchmark levels; and 4) population-to-population comparisons. This approach is detailed below.

First, a qualitative risk-screening evaluation through comparing site data to risk screening criteria (Federal and State) will identify COPCs. This qualitative risk evaluation will include a comparison using the most current USEPA Region III RBCs to site detected concentrations. The noncarcinogenic RBCs reflected in the Region III table are based on hazard quotients (HQ) of 1, which does not account for exposure of multiple constituents on a common target organ. Therefore, RBCs based on noncarcinogenic effects will be adjusted to account for a HQ of 0.1 by dividing the reported RBCs by 10. Groundwater data will first be screened using the MCL, then the tap water RBC at a HQ of 0.1.

After site COPCs are identified through the initial screening, background concentrations are evaluated to determine if any site constituents are ubiquitous to the site and not indicative of a release. The second step includes comparing maximum concentrations of site parameters considered potential constituents of concern to the background UTL. Background UTLs, which define an upper bound of concentrations that would typically be expected in areas not impacted by the site, can be used to identify samples that potentially exceed background conditions. If the maximum concentrations found at a site are less than the background UTL, then site parameter concentrations are not considered reflective of a site release. If the maximum concentration of a constituent initially identified as a COPC based on the qualitative screening is greater than the background UTL, the constituent will be considered a COPC and additional qualitative risk screening conducted.

Step 3 includes calculating an CAHI or CICR by dividing the site constituent concentration by the tap water RBC (not adjusted to an HQ of 0.1 for noncarcinogenic effects, as done for the initial screening, but based on the value in the RBC table for both cancer and noncancer endpoints) for groundwater and the residential soil RBC for soil. This is done only for COPCs that exceed background as identified in Step 3. The calculations are shown below.

$$HQ = Cmax/RBC$$

$$CAHI = \text{sum of } HQ$$

Where:

HQ = hazard quotient

Cmax = maximum detected concentration (mg/kg or μg/l)

RBC = Risk-based concentration

CAHI = cumulative apparent hazard index

For constituents identified as potential chemicals of potential concern (COPCs) from Step 1, calculate a cumulative incremental cancer risk (ICR) as follows:

$$CICR = \text{Sum of } (Cmax/RBC) * 10^{-6}$$

Where: CICR = cumulative incremental cancer risk

Cmax = maximum detected concentration (mg/kg or µg/l)

RBC = Risk-based concentration (based on CR=10^{-6})

If the CAHI for noncancer risk is less than the 0.5 and the CICR for cancer risk is less than 5x 10^{-5}, no constituents of concern are identified. If the calculated CAHI or CICR exceeds the applicable criteria, constituents that are included in the CAHI or CICR calculation are considered COPCs.

For the COPCs identified through Steps 1 through 3 as detailed above, then Step 4 includes population-to-population comparisons. If site and background populations are not statistically different, consideration is then given to the location of the maximum concentration(s) as potentially representative of a "hot spot." These specific locations are identified in order to assess whether exceedence locations cluster in an area or are interspersed throughout the portion of the site being evaluated. Spatial interpretation of background UTL exceedences requires judgmental decisions but is an indication of whether elevated levels suggest a random process as opposed to a specific release. Professional judgment will incorporate site history and operations, current site conditions, and conceptual site models for exposure pathways and receptors. Risk management decisions can then be made by the Navy in partnership with the EPA and VDEQ as well as assess site conditions for determination of no further action, limited "hot spot" remedial measures, or whether a remedial investigation is warranted for the site. Ecological evaluations as part of the Site Screening Process begin with a site conceptual model to assess potential receptors and pathways for contaminant migration for site media. If the site conceptual model suggests the potential for ecological risk, available site data are qualitatively compared to BTAG screening values. For soil, maximum and mean concentrations of site detected parameters exceeding BTAG screening values are qualitatively compared to background soil upper tolerance limits and central tendency statistics, respectively. Based on this qualitative review, the Navy in partnership with the USEPA and VDEQ will use professional judgement for risk management in the Site Screening Process. If site-specific surface water/sediment reference (upstream/upgradient) data are available, similar qualitative comparisons can be made and site conceptual models revised as appropriate within the Site Screening Process.

4.4.2 Remedial Investigations

Within the CERCLA RI Process, use of background data for comparison to site data will be addressed in the uncertainty section of the respective human health and ecological risk assessments. Until further Navy guidance is released regarding the use of background data in RI quantitative risk assessments, this data will only be used at the end of the quantitative risk assessment as part of the uncertainty section of the risk assessments.

For data collected as part of a RI, a quantitative risk assessment is conducted in accordance with Navy and EPA guidance. For parameters that are identified risk drivers, background data is used for risk management at the conclusion of the quantitative risk assessment process. In this approach, parameters that may not be related to a site release are carried through the risk assessment process. Once site risks have been quantified, uncertainties in

the risk assessment process are addressed. Background concentration of environmental media is one of several factors that can contribute to the uncertainty of the risk assessment. Best estimates of background central tendency (e.g., mean in normally or log normally distributed data or median where data follow neither theoretical distribution), and one-sided 95-percent confidence interval (UTLs) are used as part of the uncertainty analysis and incorporated into an overall summary of site risks for use in the risk management process.

In the uncertainty analysis, the mean/median background concentration is compared directly to the mean/median site concentration for parameters that are identified potential risk drivers. Although this nonstatistical approach does not take into account the variability present in the site and background data, it does tend to provide an indication of whether the site results exceed the background results. Additionally, site and background population-to-population central-tendency comparisons are evaluated for the identified potential risk drivers. Typical methods applied include parametric or non-parametric comparisons of the two populations, as performed with a t-test or Wilcox Rank Sum test, respectively. Population-to-population analysis of background and site data will determine if the two populations are statistically similar or different. Using this approach of comparing central tendency estimates for site and background concentrations, if the central tendency of site concentrations is less than background concentrations, then it can be concluded that a site release has not occurred and risk management consideration is warranted. A risk management summary will be addressed either as part of the conclusion of the RI or in the Feasibility Study (FS) for the site.

Use of background central tendency comparisons and UTLs in the uncertainty analysis and risk management process is justifiable. The exceedance of a parameter's background mean/median concentration does not presume that there has been a site release. For those parameters, comparison of site concentrations to background UTLs is conducted to further evaluate if a site release has occurred and better understand uncertainty in the risk assessment. The population-to-population comparisons are of greater relevance for parameters where background UTLs are exceeded in one or more onsite samples. While possible, it is unlikely that population-to-population comparisons will show statistically significant differences if no individual onsite values exceed the background UTL.

As previously mentioned, an overall summary of site risks and the management of site risks will be presented in the conclusions of the RI or in the FS for the site. Management of site risks requires professional judgement and will be conducted by the Navy in partnership with the USEPA and VDEQ and is based on the overall summary of site risks, site operational history, and current site conditions.

4.4.3 Constituents Reported as Undetected

Comparison of nondetected results from background data with respect to onsite sample results is appropriate to assess relative levels associated with reported detection limits. Presumably, the detection limits from onsite and reference samples would have achieved the same level of analytical sensitivity. In which case, if all onsite samples are reported as nondetects, at comparable or lower limits of detection, it may be concluded that the onsite results do not differ from reference collections.

Interpretation is more difficult when onsite samples contain one or more results that have been detected. In some cases, particularly organic quantification, it is not uncommon for parameters which are identified as "present" in the sample to be reported at concentrations less than the practical quantitation limit (typically qualified as estimated or "J" values by the analytical lab). In most of these cases, the constituent is not a substantive problem in terms of potential site contamination. Second, at the other end of the spectrum, if all results for one of these parameters has been reported as detected in all onsite samples, at levels that are substantively above the reported detection limit, onsite impacts should be considered.

For situations where only a portion of onsite results has been reported as detected, the interpretation is more complex. While statistical tests, particularly the nonparametric methods, can be used to identify statistically significant differences in the populations, it is important to identify spatially where detections occur. The decision as to whether the detections represent a release will ultimately depend upon the magnitude and spatial distribution of the detected and nondetected levels.

4.4.4 Parameters with "B" Qualified Results

For parameters that have been reported as detections qualified to note that the parameter was also detected in a quality control blank sample, the results are treated as non-detects. However, the value qualified with a "B" may be substantively different from detection limit values (qualified "U") for the same parameter. In these cases, it would be conservative to use the minimum reported nondetect (qualified "U") as a comparative value for onsite samples. Consideration for use of the "B" qualified value at one-half the reported value would be appropriate.

4.5 Background Investigation Report

The results of this investigation will be presented as an Addendum to the existing Final Background Investigation Report, St. Juliens Creek Annex Chesapeake, Virginia submitted by CH2M HILL in October 2001. A Draft Groundwater Background Investigation Addendum will be prepared for submittal to the Navy, USEPA, and VDEQ. Based on their evaluation of the results presented in the Draft Addendum, a Final Addendum will be prepared and incorporated into the existing Background Investigation Report. The Addendum will include the following:

- Introductory section summarizing the project objectives
- Rationale for the sampling locations
- Summary of the analytical data and a comparison to the risk-based screening criteria
- Description of the statistical methods
- Summary table showing the upper background concentration limit for each of the constituents analyzed.

SECTION 5

5 Project Management and Staffing

The CH2M HILL Task Manager designated for the oversight of this project is Mr. Ben Francisco. Mr. Francisco will be supported by Mr. Bill Friedmann, who serves as Activity Manager for SJCA. Mr. Francisco will be responsible for such activities as technical support and oversight, budget, and schedule review and tracking; preparation and review of invoices; personnel resources planning and allocation; and coordination with LANTDIV, SJCA, and subcontractors.

The background investigation field program will be performed by qualified CH2M HILL staff members. CH2M HILL will notify LANTDIV, Navy Regional (CNRMA), and SJCA of the schedule that CH2M HILL personnel will mobilize to the site prior to initiating field activities.

SECTION 6

6 Project Schedule

This section documents the project schedule and the due dates of deliverables. Table 6-1 shows a breakdown on primary deliverables and assumed intervals for regulatory review. Longer periods of review will result in an extended schedule.

TABLE 6-1
Proposed Project Milestones
Background Investigation, Contract Task Order 012

Key Project Milestones *	Date From Notice to Proceed		Duration
	Start	End	
Submittal Final Work Plans	07/10/03	07/10/03	1
Subcontractors Procurement	07/10/03	07/24/03	14
Utility Clearance	07/25/03	08/01/03	7
Data Collection **	08/04/03	08/22/03	21
Data Analysis	08/22/03	09/22/03	28
Data Validation	09/22/03	10/06/03	15
Data Evaluation \ Statistics	10/06/03	10/20/03	14
Prepare and Submit Draft Addendum	10/20/03	11/19/03	30
Regulatory Review	11/19/03	1/5/04	45
Prepare and Submit Final Addendum	1/5/04	1/19/04	14

* This schedule is based on the assumption that the Final Work Plan will be completed and approved by July 10, 2003.

** This project is scheduled to be conducted concurrently with the CTO -014 Site Investigation at Various Sites. The estimated time to complete the fieldwork for both projects is 21 days.

Appendix A
Site Specific Project Plan Checklists and SOPs

St. Juliens Creek Annex Background Investigation — Investigation-Derived Waste Management Plan Checklist

This checklist supplements the Master IDWM Plan with site-specific information. Once completed for a specific project, it provides necessary IDW information for each investigation. It is to be taken into the field with the Master IDWM Plan.

Site: St. Juliens Creek Annex

1. IDW Media: _____Soil cuttings
   _____Well development or purge water
   _____Decontamination residual soil and wastewater
   _____PPE or disposable equipment
   Other _____Background – Not applicable_____

2. Expected Regulatory Status: __NA__Hazardous
   _____Solid Waste
   _____Unknown
   _____Other Waste management activities regulated by OSHA Hazwoper standard (1910.120)

3. Site Location: Soil cuttings and purged groundwater will be generated at all new monitoring well locations. These materials will be disposed of at each well location by spreading it out on the ground surface.

4. Nature of Contaminants Expected: NA
   _____Petroleum contamination
   _____Polyaromatic hydrocarbon
   _____Pesticides
   _____Herbicides
   _____PCBs
   _____Metals
   _____Other – Unknown

5. Volume of IDW Expected: __NA__Drums
   _____Cubic Yards
   _____Tons
   _____Gallons

6. Compositing Strategy for Sample Collection: NA

7. IDW Storage:

__X__As per Master IDW Plan (but not anticipated) _____Other_____

8. Waste Disposal:

__X__As per Master IDW Plan (but not anticipated) _____Other_____

St. Juliens Creek Annex Background Investigation—Quality Assurance Project Plan Checklist

This checklist supplements the Master QAPP with site-specific information. Once completed for a specific project, it provides necessary quality assurance information for each investigation. It is to be taken into the field with the Master QAPP.

Site: St. Juliens Creek Annex

1. List sampling tasks: Monitoring well installation and development, groundwater sampling

2. List data quality objectives. The objectives of the Background Investigation includes:

   - Determination of background groundwater concentrations of VOCs, SVOCs, Pesticides, and metals using CLP protocols.

3. Organization:

LANTDIV Navy Technical Representative	Dawn Hayes / LANTDIV
U.S. EPA Remedial Project Manager	Todd Richardson / U.S. EPA
VDEQ Federal Facilities Project Manager	Debbie Miller / VDEQ
CH2M HILL Activity Manager	William Friedmann /CH2M HILL, WDC
Quality Control Senior Review	Donna Caldwell/CH2M HILL, WDC
Technical Project Manager	Ben Francisco / CH2M HILL, VBO
Field Team Leader (s)	Ben Francisco and Dan Holloway / CH2M HILL, VBO

4. Table of samples with analyses to be performed and associated QC samples (attached):

   SJCA Groundwater Background Investigation Work Plan

5. Analytical Quantitation Limits:
   __X__As per Table 8-2 of Master QAPP _____Other (attached)

6. QA/QC Acceptance Criteria (e.g., precision, accuracy):
   __X__As per Table 4-1 of Master QAPP _____Other (attached)

7. Data reduction, validation, and reporting:
   __X__As per Section 9 of Master QAPP _____Other (attached)

8. Internal QC Procedures (field and laboratory):
   __X__As per Section 10 of Master QAPP _____Other (attached)

9. Corrective Action:
   __X__ As per Section 14 of Master QAPP _____ Other (attached)

10. Other deviations from Master QAPP - None

St. Juliens Creek Annex Background Investigation—Site-Specific Field Sampling Plan Checklist

This checklist supplements the Master Field Sampling Plan with site-specific information. Once completed for a specific project, it provides necessary field sampling information for each investigation. It is to be taken into the field with the Master FSP.

Site: St. Juliens Creek Annex

1. Tasks to be performed:

____	Geophysical surveys	____	In-situ groundwater sampling
____	Soil gas surveys	____	Aquifer testing
____	Sediment Sampling	____	Hydrogeologic measurements
____	Surface soil sampling	____	Biota sampling
____	Soil boring installation	____	Trenching
____	Subsurface soil sampling	____	Land surveying
__X__	Monitoring well installation and development	____	Investigation derived waste sampling
____	Monitoring well abandonment	____	Decontamination
__X__	Groundwater sampling	____	Other____

2. Field measurements to be taken:

__X__	temperature	__X__	surveying
__X__	pH	____	magnetometry
__X__	dissolved oxygen	____	global positioning system
__X__	turbidity	____	soil gas parameters (list):
__X__	specific conductance	____	combustible gases
__X__	organic vapor monitoring	__X__	water-level measurements
____	geophysical parameters (list):	__X__	pumping rate
____	electromagnetic induction	____	other____
____	ground-penetrating radar		

3. Sampling program (nomenclature, etc.):

__X__ As per Section 3.1 of Master FSP ____ Other

4. Map of well installation and sampling locations (attach to checklist): See St. Juliens Creek Annex Groundwater Background Investigation Work Plan.

5. Table of field samples to be collected: See St. Juliens Creek Annex Groundwater Background Investigation Work Plan.

6. Applicable SOPs (Master Project Plans) or references to specific pages in Master FSP:

- Installation of Shallow Monitoring Wells
- Field Measurement of pH
- Field Measurement of Specific Conductance and Temperature
- Groundwater Sampling at Monitoring Wells
- Low Flow Groundwater Sampling
- Water Level Measurement
- Chain-of-Custody
- Packaging and Shipping Procedures
- Equipment and Field Rinse Blank Preparation

Site-specific procedures or updates to protocols established in the Master FSP:
Described in the St. Juliens Creek Annex Groundwater Background Investigation Work Plan.

St. Juliens Creek Annex Background Investigation—Site-Specific Health and Safety Plan Checklist

This checklist must be used in conjunction with the Master HASP. This checklist is intended for use by CH2M HILL employees only. All CH2M HILL employees performing tasks under this checklist must read and sign both this checklist and the Master HASP and agree to abide by their provisions (see EMPLOYEE SIGNOFF attached to the checklist).

Site: St. Juliens Creek Annex

Location(s): Sampling Location Maps attached (SJCA Groundwater Background Investigation Work Plan)

This document shall be maintained on site with the Master Health and Safety Plan. It will include as attachments from the Work Plan a site map and the site characterization and objectives for this site.

The procedures described in the Master Health and Safety Plan will be followed unless otherwise specified in this Site-Specific Health and Safety Plan.

1. HAZWOPER-Regulated Tasks:

___ Test pit and excavation	_X_ Groundwater sampling
___ Soil boring installation	___ Aquifer testing
___ Hollow stem boring	___ Hydrologic measurements
___ Geophysical surveys	___ Surface water sampling
___ Hand augering	___ Biota sampling
___ Subsurface soil sampling	___ Investigation-derived waste (drum) sampling and disposal
___ Surface soil sampling	___ Observation of loading of material for offsite disposal
___ Soil gas surveys	___ Oversight of remediation and construction
___ Sediment sampling	___ Other_____
_X_ Monitoring well/drive point installation	
___ Monitoring well abandonment	

2. Hazards of Concern: (Check as many as are applicable. Refer to Section 3 of Master H&S Plan for control measures):

___ Heat stress	_X_ Back injury
___ Cold stress	___ Confined space entry
_X_ Buried utilities, drums, tanks	___ Trenches, excavations
___ Inadequate illumination	___ Protruding objects
_X_ Drilling	_X_ Vehicle traffic
___ Heavy equipment	___ Ladders, scaffolds
___ Working near water	___ Fire
___ Flying debris	___ Working on water
___ Gas cylinders	_X_ Snakes or insects
_X_ Noise	_X_ Poison ivy, oak, sumac
_X_ Slip, trip, or fall hazards	_X_ Ticks

_____Radiological _____Other_____

3. Contaminants of Concern (List if known. Refer to Table 3.8 of the Master HSP)

Volatile organic compounds, PAHs, pesticides, PCBs, metals

4. Personnel (List CH2M HILL field team members and telephone numbers):

Field team leader(s) Ben Francisco (757-460-3734 ext. 20) and Dan Holloway (757-460-3734 ext. 30)

Site safety coordinator(s) Ben Francisco (757-460-3734 ext. 20) and Dan Holloway (757-460-3734 ext. 30)

Field team members: To be determined (TBD)

5. Contractors/Subcontractors:

__X___Procedures as per Master HASP

__X___Other No subcontractors have been identified at the writing of this HASP checklist.

Name: TBD _____ _____

Contact: TBD _____ _____

Telephone: TBD _____ _____

6. Level of personal protective equipment (PPE) required:___D_____
Refer to Table 5.1 of Master HASP, CH2M HILL SOPs, and Respiratory Protection, Section 2 of the Site Safety Notebook.

7. Air monitoring instruments to be used (refer to Master HSP for action levels):

_____OVM 10.6 _____FID

_____CGI _____Dust monitor

_____O_2 ____PID

8. Decontamination procedures:

_____As per Section 7 of Master HASP

__X__Other As described in the St. Juliens Creek Annex Groundwater Background Investigation Work Plan.

9. List any other deviations or variations from the Master HASP: None

10. Emergency Response. (Check that all names and numbers are correct on page 38 of Master HASP and attach corrected page to this checklist)

11. Map to Hospital (Figure A-1). (Highlight route to hospital from site and attach to this checklist)

12. Emergency Contacts. (Check that all names and numbers are correct on page 38 of Master HASP and attach corrected page to this checklist)

13. Approval. This prepared site-specific checklist must be approved by John Longo/NJO or authorized representative

Name John Longo/NJO Title: Health and Safety Manager Date:

14. Employee Signoff. All CH2M HILL employees working at the site must sign the attached Employee Signoff for the checklist as well as for the Master HASP.

_____Site

HASP Checklist Employee Signoff

The employees listed below have been given a copy of both this health and safety plan checklist and the Master HSP, have read and understood them, and agree to abide by their provisions.

EMPLOYEE NAME	EMPLOYEE SIGNATURE AND DATE

Appendix B
CH2M HILL Field Safety Instructions

CH2M HILL FIELD SAFETY INSTRUCTIONS

These Field Safety Instructions (FSI) will be kept onsite during field activities and will be reviewed as necessary. The FSI will be amended or revised as project activities or conditions change or when supplemental information becomes available. The FSI adopts, by reference, the Standards of Practice (SOPs) in the CH2M HILL *Corporate Health and Safety Program, Program and Training Manual*, as appropriate. In addition, these FSI may adopt procedures from the project Work Plan. The Designated Safety Coordinator (DSC) is to be familiar with these SOPs and the content of these instructions. CH2M HILL's personnel and subcontractors must sign Attachment 1.

Project Information and Description

PROJECT NO: 180247.FI.WP

CLIENT: Navy

PROJECT/SITE NAME: St. Juliens Creek Annex

SITE ADDRESS: Chesapeake, Virginia

CH2M HILL PROJECT MANAGER: Ben Francisco

CH2M HILL OFFICE: Virginia Beach

DATE FIELD SAFETY INSTRUCTIONS PREPARED: 4/16/2003

DATE(S) OF SITE WORK: June-July 2003

SITE DESCRIPTION AND HISTORY: Areas on site not known to be impacted by disposal practices.

DESCRIPTION OF SPECIFIC TASKS TO BE PERFORMED BY CH2M HILL: Oversite of monitoring well installation and groundwater sampling activities.

1 Project Organization and Responsibilities

1.1 Client

Contact Name: Dawn Hayes
Phone: 757/322-4792
Facility Contact Name: Leroy Eaves
Phone: 757/485-6574

1.2 CH2M HILL

Project Manager: Ben Francisco
Health and Safety Manager (HSM): John Longo
Designated Safety Coordinator (DSC): Ben Francisco

The DSC is responsible for verifying that the project is conducted in a safe manner including the following specific obligations:

- Verify these FSI are current and amended when project activities or conditions change
- Verify CH2M HILL site personnel and subcontractor personnel read these FSI and sign Attachment 1 "Employee Signoff Form" prior to commencing field activities
- Verify CH2M HILL site personnel and subcontractor personnel have completed any required specialty training (e.g., fall protection, confined space entry) and medical surveillance as identified in Section 2
- Verify compliance with the requirements of these FSI and applicable subcontractor health and safety plan(s)
- Act as the project "Hazard Communication Coordinator" and perform the responsibilities outlined in Section 2.2.2
- Act as the project "Emergency Response Coordinator" and perform the responsibilities outlined in Section 4
- Post OSHA job-site poster; the poster is required at sites where project field offices, trailers, or equipment-storage boxes are established; posters can be obtained by calling 800/548-4776 or 800/999-9111
- Verify that safety meetings are conducted and documented in the project file initially and as needed throughout the course of the project (e.g., as tasks or hazards change)
- Verify that project H&S forms and permits, found in Attachment 5, are being used as outlined in Section 2
- Verify that project activity self-assessment checklists, found in Attachment 6, are being used as outlined in Section 2

1.3 CH2M HILL Subcontractors

(Reference CH2M HILL SOP HS-55, *Subcontractor, Contractor, and Owner*)

Subcontractor: TBD
Subcontractor Contact Name:
Telephone:
Subcontractor Task(s): Surveying

Subcontractor: TBD
Subcontractor Contact Name:
Telephone:
Subcontractor Task(s): Utility clearance locates

Subcontractor: TBD
Subcontractor Contact Name:
Subcontractor Competent Person:
Telephone:
Subcontractor Task(s): UXO clearance

Subcontractor: TBD
Subcontractor Contact Name:
Subcontractor Competent Person:
Telephone:
Subcontractor Task(s): Drilling

The subcontractors listed above are covered by this FSI and must be provided a copy of this plan. However, these instructions do not address hazards associated with the tasks and equipment that the subcontractor has expertise in (e.g., drilling, excavation work, electrical). Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit these procedures to CH2M HILL for review before the start of field work. Subcontractors must comply with the established health and safety plan(s). The CH2M HILL DSC should verify that subcontractor employee training, medical clearance, and fit test records are current and must monitor and enforce compliance with the established plan(s). CH2M HILL's oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

CH2M HILL should continuously endeavor to observe subcontractors' safety performance. This endeavor should be reasonable, and include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL is not responsible for exhaustive observation for hazards and unsafe practices. In addition to this level of observation, the DSC is responsible for confirming CH2M HILL subcontractor performance against both the subcontractor's safety plan and applicable self-assessment checklists. Self-assessment checklists contained in Attachment 6 are to be used by the DSC to review subcontractor performance.

Health and safety related communications with CH2M HILL subcontractors should be conducted as follows:

- Brief subcontractors on the provisions of this plan, and require them to sign the Employee Signoff Form included in Attachment 1.
- Request subcontractor(s) to brief project team on the hazards and precautions related to their work.
- When apparent non-compliance/unsafe conditions or practices are observed, notify the subcontractor safety representative and require corrective action – the subcontractor is responsible for determining and implementing necessary controls and corrective actions.
- When repeat non-compliance/unsafe conditions are observed, notify the subcontractor safety representative and stop affected work until adequate corrective measures are implemented.
- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify subcontractor safety representative, and stop affected work until adequate corrective measures are implemented. Notify the Project Manager and HSM as appropriate.
- Document all oral health and safety related communications in project field logbook, daily reports, or other records.

1.4 Contractors

(Reference CH2M HILL SOP HS-55, *Subcontractor, Contractor, and Owner*)

Contractor: N/A
Contractor Contact Name:
Telephone:
Contractor Task(s):

These instructions do not cover contractors that are contracted directly to the client or the owner. CH2M HILL is not responsible for the health and safety or means and methods of the contractor's work, and we must never assume such responsibility through our actions (e.g., advising on H&S issues). In addition to these instructions, CH2M HILL staff should review contractor safety plans so that we remain aware of appropriate precautions that apply to us. Except in unusual situations when conducted by the HSM, CH2M HILL must never comment on or approve contractor safety procedures. In addition to these instructions, CH2M HILL staff unusual situations when conducted by the HSM, CH2M HILL must never comment on or approve contractor safety procedures. Self-assessment checklists contained in Attachment 6 are to be used by the DSC to review the contractor's performance ONLY as it pertains to evaluating our exposure and safety.

Health and safety related communications with contractors should be conducted as follows:

- Request the contractor to brief CH2M HILL employees and subcontractors on the precautions related to the contractor's work.
- When an apparent contractor non-compliance/unsafe condition or practice poses a risk to CH2M HILL employees or subcontractors:
  - Notify the contractor safety representative
  - Request that the contractor determine and implement corrective actions

  - If needed, stop affected CH2M HILL work until contractor corrects the condition or practice. Notify the client, Project Manager, and HSM as appropriate.
- If apparent contractor non-compliance/unsafe conditions or
- When an apparent contractor non-compliance/unsafe condition or practice poses a risk to CH2M HILL employees or subcontractors:
- Notify the contractor safety representative
- Request contractor to determine and implement corrective actions
- If needed, stop affected CH2M HILL work until contractor corrects. Notify the client, Project Manager, and Health and Safety Manager as appropriate.
- If apparent contractor non-compliance/unsafe conditions or practices are observed, inform the contractor safety representative. Our obligation is limited strictly to informing the contractor of our observation – the contractor is solely responsible for determining and implementing necessary controls and corrective actions.
- If an apparent imminent danger is observed, immediately warn the contractor employee(s) in danger and notify the contractor safety representative. Our obligation is limited strictly to immediately warning the affected individual(s) and informing the contractor of our observation – the contractor is solely responsible for determining and implementing necessary controls and corrective actions.
- Document all oral health and safety related communications in project field logbook, daily reports, or other records.

2 Hazard Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the site or the particular hazard. CH2M HILL employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M HILL employees and subcontractors who do not understand any of these provisions should contact the DSC for clarification.

In addition to the controls specified in this section, Project-Activity Self-Assessment Checklists are contained in Attachment 6. These checklists are to be used to assess the adequacy of CH2M HILL and subcontractor site-specific safety requirements. The objective of the self-assessment process is to identify gaps in project safety performance, and prompt for corrective actions in addressing these gaps. Self-assessment checklists should be completed early in the project, when tasks or conditions change, or when otherwise specified by the HSM. The self-assessment checklists, including documented corrective actions, should be made part of the permanent project records, and be promptly submitted to the HSM.

Project-specific frequency for completing self-assessments: Weekly during drilling activities.

2.1 Project-Specific Hazards

2.1.1 Drilling

(Reference CH2M HILL SOP HS-35, *Drilling*)

- Only authorized personnel are permitted to operate drill rigs.
- Stay clear of areas surrounding drill rigs during every startup.
- Stay clear of the rotating augers and other rotating components of drill rigs.
- Stay as clear as possible of all hoisting operations. Loads shall not be hoisted overhead of personnel.
- Do not wear loose-fitting clothing or other items such as rings or watches that could get caught in moving parts. Long hair should have it restrained.
- If equipment becomes electrically energized, personnel shall be instructed not to touch any part of the equipment or attempt to touch any person who may be in contact with the electrical current. The utility company or appropriate party shall be contacted to have line de-energized prior to approaching the equipment.
- Smoking around drilling operations is prohibited.

2.2 General Hazards

2.2.1 General Practices and Housekeeping (Reference CH2M HILL SOP HS-20, *General Practices*)

- Site work should be performed during daylight hours whenever possible. Work conducted during hours of darkness require enough illumination intensity to read a newspaper without difficulty.
- Good housekeeping must be maintained at all times in all project work areas.
- Common paths of travel should be established and kept free from the accumulation of materials.
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions.
- Provide slip-resistant surfaces, ropes, and/or other devices to be used.
- Specific areas should be designated for the proper storage of materials.
- Tools, equipment, materials, and supplies shall be stored in an orderly manner.
- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area.
- Containers should be provided for collecting trash and other debris and shall be removed at regular intervals.
- All spills shall be quickly cleaned up. Oil and grease shall be cleaned from walking and working surfaces.

2.2.2 Hazard Communication (Reference CH2M HILL SOP HS-05, *Hazard Communication)*

The DSC is to perform the following:

- Complete an inventory of chemicals brought on site by CH2M HILL using Attachment 2.
- Confirm that an inventory of chemicals brought on site by CH2M HILL subcontractors is available.
- Request or confirm locations of Material Safety Data Sheets (MSDSs) from the client, contractors, and subcontractors for chemicals to which CH2M HILL employees potentially are exposed.
- Before or as the chemicals arrive on site, obtain an MSDS for each hazardous chemical.
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly.
- Give employees who either use or are exposed to hazardous chemicals site-specific HAZCOM training. Refer to guidelines in Attachment 3.
- Store all materials properly, giving consideration to compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

2.2.3 Shipping and Transportation of Chemical Products

(Reference CH2M HILL's *Procedures for Shipping and Transporting Dangerous Goods)*

Chemicals brought to the site might be defined as hazardous materials by the U.S. Department of Transportation (DOT). All staff who ship the materials or transport them by road must receive CH2M HILL training in shipping dangerous goods. All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. Contact the HSM or the Equipment Coordinator for additional information.

2.2.4 Manual Lifting (Reference CH2M HILL, SOP HS-29, *Lifting)*

- Proper lifting techniques must be used when lifting any object.
  - Plan storage and staging to minimize lifting or carrying distances.
  - Split heavy loads into smaller loads.
  - Use mechanical lifting aids whenever possible.
  - Have someone assist with the lift -- especially for heavy or awkward loads.
  - Make sure the path of travel is clear prior to the lift.

2.2.5 Fire Prevention (Reference CH2M HILL, SOP HS-22, *Fire Prevention)*

- Fire extinguishers shall be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 feet. When 5 gallons or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 feet. Extinguishers must:
- be maintained in a fully charged and operable condition,
- be visually inspected each month, and
- undergo a maintenance check each year.

- The area in front of extinguishers must be kept clear.
- Post "Exit" signs over exiting doors, and post "Fire Extinguisher" signs over extinguisher locations.
- Combustible materials stored outside should be at least 10 feet from any building.
- Solvent waste and oily rags must be kept in a fire resistant, covered container until removed from the site.
- Flammable/combustible liquids must be kept in approved containers, and must be stored in an approved storage cabinet.

2.2.6 Compressed Gas Cylinders

- Valve caps must be in place when cylinders are transported, moved, or stored.
- Cylinder valves must be closed when cylinders are not being used and when cylinders are being moved.
- Cylinders must be secured in an upright position at all times.
- Cylinders must be shielded from welding and cutting operations and positioned to avoid being struck or knock over; contacting electrical circuits; or exposed to extreme heat sources.
- Cylinders must be secured on a cradle, basket, or pallet when hoisted; they may not be hoisted by choker slings.

2.2.7 Procedures for Locating Buried Utilities

Local Utility Mark-Out Service

Name: Base Public Works Center and Utility Clearance Subcontractor (TBD)
Phone: TBD

- Where available, obtain utility diagrams for the facility.
- Review locations of sanitary and storm sewers, electrical conduits, water supply lines, natural gas lines, and fuel tanks and lines.
- Review proposed locations of intrusive work with facility personnel knowledgeable of locations of utilities. Check locations against information from utility mark-out service.
- Where necessary (e.g., uncertainty about utility locations), excavation or drilling of the upper depth interval should be performed manually
- Monitor for signs of utilities during advancement of intrusive work (e.g., sudden change n advancement of auger or split spoon).
- When the client or other onsite party is responsible for determining the presence and locations of buried utilities, the DSC should confirm that arrangement.

2.3 Biological Hazards and Controls

2.3.1 Snakes

Snakes typically are found in underbrush and tall grassy areas. If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If a person is bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Seek medical attention immediately. **DO NOT** apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings.

2.3.2 Poison Ivy and Poison Sumac

Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas. Become familiar with the identity of these plants. Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and water immediately. If the reaction is severe or worsens, seek medical attention.

2.3.3 Ticks

Ticks typically are in wooded areas, bushes, tall grass, and brush. Ticks are black, black and red, or brown and can be up to one-quarter inch in size. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into boots; spray **only outside** of clothing with permethrin or permanone and spray skin with only DEET; and check yourself frequently for ticks.

If bitten by a tick, grasp it at the point of attachment and carefully remove it. After removing the tick, wash your hands and disinfect and press the bite areas. Save the removed tick. Report the bite to human resources. Look for symptoms of Lyme disease or Rocky Mountain spotted fever (RMSF). Lyme: a rash might appear that looks like a bullseye with a small welt in the center. RMSF: a rash of red spots under the skin 3 to 10 days after the tick bite. In both cases, chills, fever, headache, fatigue, stiff neck, and bone pain may develop. If symptoms appear, seek medical attention.

2.3.4 Bees and Other Stinging Insects

Bee and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform the DSC and/or buddy. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; seek medical attention if a reaction develops.

2.3.5 Bloodborne Pathogens (Reference CH2M HILL SOP HS-36, *Bloodborne Pathogens*)

Exposure to bloodborne pathogens may occur when rendering first aid or CPR, or when coming into contact with landfill waste or waste streams containing potentially infectious material. Exposure controls and personal protective equipment (PPE) are required as specified in CH2M HILL SOP HS-36, *Bloodborne Pathogens*. Hepatitis B vaccination must be offered before the person participates in a task where exposure is a possibility.

2.3.6 Mosquitoes and West Nile Virus

The following information is taken from the Centers for Disease Control and Prevention (CDC) Website:

Human illness from West Nile virus is rare, even in areas where the virus has been reported. The chance that any one person is going to become ill from a mosquito bite is low. On rare occasions, West Nile virus infection can result in a severe and sometimes fatal illness known as West Nile encephalitis (an inflammation of the brain). The risk of severe disease is higher for persons 50 years of age and older. There is no evidence to suggest that West Nile virus can be spread from person to person or from animal to person.

Most infections of West Nile encephalitis are mild, and symptoms include fever, headache, and body aches, occasionally with skin rash and swollen lymph glands. More severe infection may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and rarely, death. The incubation period in humans (i.e., time from infection to onset of disease symptoms) for West Nile encephalitis is usually 3 to 15 days. If symptoms occur, see your doctor immediately.

You can reduce your chances of becoming ill by protecting yourself from mosquito bites. To avoid mosquito bites:

- Apply insect repellent containing DEET (N,N-diethyl-meta-toluamide) when you're outdoors. Apply sparingly to exposed skin. DEET in high concentrations (greater than 35%) provides no additional protection.
- Spray clothing with repellents containing permethrin or DEET since mosquitoes may bite through thin clothing.
- Read and follow the product directions whenever you use insect repellent.
- Wear long-sleeved clothes and long pants treated with repellent and stay indoors during peak mosquito feeding hours (dusk until dawn) to further reduce your risk.
- Limit the number of places available for mosquitoes to lay their eggs by eliminating standing water sources.

2.3.7 Snapping Turtles

Snapping turtles are approximately 20-47 cm in length, with a massive head and powerful jaws. Males are often larger than females. In both sexes, the heavily-serrated shell is tan to dark brown. Snapping turtles can be found in freshwater and brackish areas, and prefer soft mud bottoms and abundant vegetation. They are not aggressive or territorial and will usually move out of an area if the water is disturbed by a large animal. Nevertheless, turtles should never be picked up and moved. Although turtles are not poisonous, treat a turtle bit with the same care as a snake bite. Remain calm and proceed to the nearest hospital immediately.

3 Personal Protective Equipment (PPE)

(Reference CH2M HILL SOP HS-07, *Personal Protective Equipment and* HS-08, *Respiratory Protection*)

Note that PPE is required when exposed to the general hazards listed below. Because certain tasks (e.g., welding, energized work, etc.) require specialized PPE, refer to Section 2 for task-specific PPE requirements.

PPE Specifications [a]

Hazard	PPE
General entry to active industrial facility or construction site, or when required by client/facility.	ANSI approved steel-toe leather work boots, safety glasses, and hardhat.
Skin absorption of harmful substances, severe cuts or lacerations, severe abrasions, punctures, chemical burns, thermal burns and harmful temperature extremes.	Leather work gloves for protection against cuts and abrasions; nitrile, or other appropriate chemical-resistant gloves for protection against contact with chemicals.
Working around heavy equipment or other noisy machinery, or if you must raise your voice to be heard while communicating with persons near you, hearing protection is required.	ANSI approved ear plugs or earmuffs.
Danger of foot injuries due to falling or rolling objects, objects piercing the sole, or when the feet are exposed to electrical hazards.	Sturdy footwear or ANSI approved steel-toed leather work boots.
Potential for head injury from impact, falling or flying objects.	ANSI approved hardhat.
Flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation.	ANSI approved safety glasses with side shield, safety goggles, face shield, or welding glasses. Face shield may be used only in conjunction with the use of other protective eyewear.

Reasons for Upgrading or Downgrading Level of Protection

Upgrade[b]	Downgrade
• Request from individual performing tasks.	• Situation is less hazardous than originally thought.
• Change in work tasks that will increase potential for injury.	• Change in site conditions that decreases the hazard.
• Known or suspected presence of dermal hazards.	• Change in work task that will reduce potential for injury.

[a] CH2M HILL will provide PPE only to CH2M HILL employees.

[b] Performing tasks that require respiratory protection is permitted only when the PPE requirements have been approved by the HSM, and a DSC qualified at that level is present.

4 Emergency Response

(Reference CH2M HILL, SOP HS-12, *Emergency Response*)

4.1 Pre-Emergency Planning

The DSC performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M HILL onsite parties, the facility, and local emergency-service providers as appropriate.

- Review the facility emergency and contingency plans where applicable.
- Determine what onsite communication equipment is available (e.g., two-way radio, air horn).
- Determine what offsite communication equipment is needed (e.g., nearest telephone, cell phone).
- Confirm and post emergency telephone numbers, evacuation routes, assembly areas, and route to hospital; communicate the information to onsite personnel.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases.
- Field Trailers: Post "Exit" signs above exit doors, and post "Fire Extinguisher" signs above locations of extinguishers. Keep areas near exits and extinguishers clear.
- Designate one vehicle as the emergency vehicle; place hospital directions and map inside; keep keys in ignition during field activities.
- Inventory and check site emergency equipment, supplies, and potable water.

4.2 Emergency Equipment and Supplies

The DSC should verify that these supplies are available, as needed, and in proper working order and mark the locations of emergency equipment on the site map, when a map is provided.

Emergency Equipment and Supplies	Location
20 lb (or two 10-lb) fire extinguisher (A, B, and C classes)	Fleet Vehicle
First aid kit	Fleet Vehicle
Personal Eye wash	Fleet Vehicle
Potable water	Fleet Vehicle
Bloodborne-pathogen kit	Fleet Vehicle
Additional equipment (specify):	NA

4.3 Incident Response

In fires, explosions, or chemical releases, actions to be taken include the following:

- Shut down CH2M HILL operations and evacuate the immediate area.
- Notify appropriate response personnel.
- Account for personnel at the designated assembly area(s).
- Assess the need for site evacuation, and evacuate the site as warranted.

Instead of implementing a work-area evacuation, note that small fires or spills posing minimal safety or health hazards may be controlled.

4.4 Evacuation Procedures

- Evacuation routes and assembly areas will be designated by the DSC before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The DSC and a "buddy" will remain on the site after the site has been evacuated (if safe) to inform local responders of the nature and location of the incident.
- The DSC will account for all personnel at the assembly area.

- The DSC will write up the incident as soon as possible after it occurs and submit a report to the Corporate Director of Health and Safety.

4.5 Emergency Medical Treatment

The procedures listed below may also be applied to non-emergency incidents. Injuries and illnesses (including overexposure to contaminants) must be reported to Human Resources. If there is doubt about whether medical treatment is necessary, or if the injured person is reluctant to accept medical treatment, contact the CH2M HILL medical consultant. During non-emergencies, follow these procedures as appropriate.

- Notify appropriate emergency response authorities listed in Attachment 4 (e.g., 911).
- The DSC will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury.
- Initiate first aid and CPR where feasible.
- Get medical attention immediately.
- Make certain that the injured person is accompanied to the emergency room.
- When contacting the medical consultant, state that the situation is a CH2M HILL matter, and give your name and telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.
- Report incident as outlined in Section 4.6

4.6 Incident Notification and Reporting

- Upon any project incident (fire, spill, injury, near miss, death, etc.), immediately notify the PM and HSM. Call emergency beeper number if HSM is unavailable.
- For CH2M HILL work-related injuries or illnesses, contact and help Human Resources administrator complete an Incident Report Form (IRF). IRF must be completed within 24 hours of incident.
- For CH2M HILL subcontractor incidents, complete the Subcontractor Accident/Illness Report Form and submit to the HSM.
- Notify and submit reports to client as required in contract.

5 Approval

This FSI has been written for use by CH2M HILL and their subcontractors only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The FSI is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if those conditions change.

5.1 Original Plan

Written By: Jamie Culbreth/VBO **Date:** April 16, 2003

Approved By: **Date:**

5.2 Revisions

Revisions Made By: **Date:**

Revisions to Plan:

Revisions Approved By: **Date:**

6 Attachments

Attachment 1: **Employee Signoff Form – Field Safety Instructions**
Attachment 2: **Project-Specific Chemical Product Hazard Communication Form**
Attachment 3: **Chemical-Specific Training Form**
Attachment 4: **Emergency Contacts**
Attachment 5: **Project Activity Self-Assessment Checklists**
Attachment 6: **Applicable Material Safety Data Sheets**

CH2MHILL

EMPLOYEE SIGNOFF FORM

Field Safety Instructions

The CH2M HILL project employees and subcontractors listed below have been provided with a copy of this FSI, have read and understood it, and agree to abide by its provisions.

Project Name: St. Juliens Creek Annex, Chesapeake, Virginia **Project Number:** 180247.FI.WP

EMPLOYEE NAME (Please print)	**EMPLOYEE SIGNATURE**	**COMPANY**	**DATE**

CH2MHILL

Project-Specific Chemical Product Hazard Communication Form

This form must be completed prior to performing activities that expose personnel to hazardous chemicals products. Upon completion of this form, the DSC shall verify that training is provided on the hazards associated with these chemicals and the control measures to be used to prevent exposure to CH2M HILL and subcontractor personnel. Labeling and MSDS systems will also be explained.

Project Name: St. Juliens Creek Annex **Project Number:** 180247.FI.WP

MSDSs will be maintained at the following location(s):

Hazardous Chemical Products Inventory

Chemical	Quantity	Location	MSDS Available	Container labels	
				Identity	Hazard

Refer to SOP HS-05 *Hazard Communication* for more detailed information.

CH2MHILL

CHEMICAL-SPECIFIC TRAINING FORM

Location:	Project # : 180247.FI.WP
HCC:	Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

The HCC shall use the product MSDS to provide the following information concerning each of the products listed above.

☐ Physical and health hazards

☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)

☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of MSDSs, chemical inventories, and CH2M HILL's written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

Emergency Contacts

24-hour CH2M HILL Emergency Beeper – 888/444-1226

Medical Emergency – 911
Facility Medical Response #: 757-396-3333
Local Ambulance #: 757-396-3333

CH2M HILL Medical Consultant
Health Resources
Dr. Jerry H. Berke, M.D., M.P.H.
600 West Cummings Park, Suite 3400
Woburn, MA 01801-6350
1-781-938-4653 1-800-350-4511
(After hours calls will be returned within 20 minutes)

Fire/Spill Emergency -- 911
Facility Fire Response #: 757-396-3335
Local Fire Dept #: 757-382-6297

Local Occupational Physician
Maryview Hospital
757-398-2200

Security & Police – 911
Facility Security #: 757-396-5111
Local Police #: 757-396-6161

Corporate Director Health and Safety
Name: David Waite/SEA
Phone: 206/453-5005
24-hour emergency beeper: 888-444-1226

Utilities Emergency
Water: 757-382-3550
Gas: 1-877-572-3342
Electric: 1-888-667-3000

Health and Safety Manager (HSM)
Name: John Longo
Phone: 973-316-9300 x4543

Designated Safety Coordinator (DSC)
Name: Ben Francisco
Phone: 757-460-3734x20

Regional Human Resources Department
Name: Cindy Bauder
Phone: 703-471-1508

Project Manager
Name: Ben Francisco
Phone: 757-460-3734x20

Corporate Human Resources Department
Name: Pete Hannan/COR
Phone: 303/771-0900

Federal Express Dangerous Goods Shipping
Phone: 800/238-5355

CH2M HILL Emergency Number for Shipping Dangerous Goods
Phone: 800/255-3924

Worker's Compensation:
Contact Regional HR dept. to have form completed or contact Julie Zimmerman after hours: 303/664-3304

Automobile Accidents:
Rental: Carol Dietz/COR 303/713-2757
CH2M HILL owned vehicle:
Zurich Insurance Co. 800/987-3373

Contact the Project Manager. Generally, the Project Manager will contact relevant government agencies.

Facility Alarms: To be identified on site

Evacuation Assembly Area(s): To be determined on site

Facility/Site Evacuation Route(s): See Site Map

Hospital Name/Address: Mayview Hospital/Oakley Street

Hospital Phone #: 757-398-2200

Directions to Hospital

Leave the main gate of the Annex and take a left onto Victory Blvd. At Route 17 (George Washington Hwy) take a right and go north. Make left onto Fredrick Blvd. and continue until it dead-ends. Make left onto High Street, the hospital is on the right at the first light.

CH2M HILL FIELD SAFETY INSTRUCTIONS

Attachment 5

Project Activity Self-Assessment Checklists

CH2MHILL

H&S Self-Assessment Checklist - DRILLING

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: 1) CH2M HILL employees are potentially exposed to hazards associated with drilling operations (complete Sections 1 and 3), and/or 2) CH2M HILL oversight of a drilling subcontractor is required (complete entire checklist).

SSC/DSC may consult with drilling subcontractors when completing this checklist, but shall not direct the means and methods of drilling operations nor direct the details of corrective actions. Drilling subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Completed checklists shall be sent to the health and safety manager for review.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposures to drilling hazards
☐ Evaluate a CH2M HILL subcontractor's compliance with drilling H&S requirements
Subcontractors Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the drilling subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HS-35.

SECTION 1	Yes	No	N/A	N/O
PERSONNEL SAFE WORK PRACTICES (3.1)				
1. Only authorized personnel operating drill rig	☐	☐	☐	☐
2. Personnel cleared during rig startup	☐	☐	☐	☐
3. Personnel clear of rotating parts	☐	☐	☐	☐
4. Personnel not positioned under hoisted loads	☐	☐	☐	☐
5. Loose clothing and jewelry removed	☐	☐	☐	☐
6. Personnel instructed not to approach equipment that has become electrically energized	☐	☐	☐	☐
7. Smoking is prohibited around drilling operation	☐	☐	☐	☐
8. Personnel wearing appropriate PPE, per HSP/FSI	☐	☐	☐	☐

SECTION 2	Yes	No	N/A	N/O
GENERAL (3.2.1)				
9. Daily safety briefing/meeting conducted with crew	☐	☐	☐	☐
10. Daily inspection of drill rig and equipment conducted before use	☐	☐	☐	☐
DRILL RIG PLACEMENT (3.2.2)				
11. Location of underground utilities identified	☐	☐	☐	☐
12. Safe clearance distance maintained from overhead powerlines	☐	☐	☐	☐
13. Drilling pad established, when necessary	☐	☐	☐	☐
14. Drill rig leveled and stabilized	☐	☐	☐	☐
DRILL RIG TRAVEL (3.2.3)				
15. Rig shut down and mast lowered and secured prior to rig movement	☐	☐	☐	☐
16. Tools and equipment secured prior to rig movement	☐	☐	☐	☐
17. Only personnel seated in cab are riding on rig during movement	☐	☐	☐	☐
18. Safe clearance distance maintained while traveling under overhead powerlines	☐	☐	☐	☐
19. Backup alarm or spotter used when backing rig	☐	☐	☐	☐
DRILL RIG OPERATION (3.2.4)				
20. Kill switch clearly identified and operational	☐	☐	☐	☐
21. All machine guards are in place	☐	☐	☐	☐
22. Rig ropes not wrapped around body parts	☐	☐	☐	☐
23. Pressurized lines and hoses secured from whipping hazards	☐	☐	☐	☐
24. Drill operation stopped during inclement weather	☐	☐	☐	☐
25. Air monitoring conducted per HSP/FSI for hazardous atmospheres	☐	☐	☐	☐
26. Rig placed in neutral when operator not at controls	☐	☐	☐	☐
DRILL RIG MAINTENANCE (3.2.5)				
27. Defective components repaired immediately	☐	☐	☐	☐
28. Lockout/tagout procedures used prior to maintenance	☐	☐	☐	☐
29. Cathead in clean, sound condition	☐	☐	☐	☐
30. Drill rig ropes in clean, sound condition	☐	☐	☐	☐
31. Fall protection used for fall exposures of 6 feet or greater	☐	☐	☐	☐
32. Rig in neutral and augers stopped rotating before cleaning	☐	☐	☐	☐
33. Good housekeeping maintained on and around rig	☐	☐	☐	☐
DRILLING AT HAZARDOUS WASTE SITES (3.2.6)				
34. Waste disposed of according to HSP	☐	☐	☐	☐
35. Appropriate decontamination procedures being followed, per HSP	☐	☐	☐	☐

Rev.0

<u>SECTION 3</u>

Complete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

CH2M HILL FIELD SAFETY INSTRUCTIONS

Attachment 6

Applicable Material Safety Data Sheets

Hospital

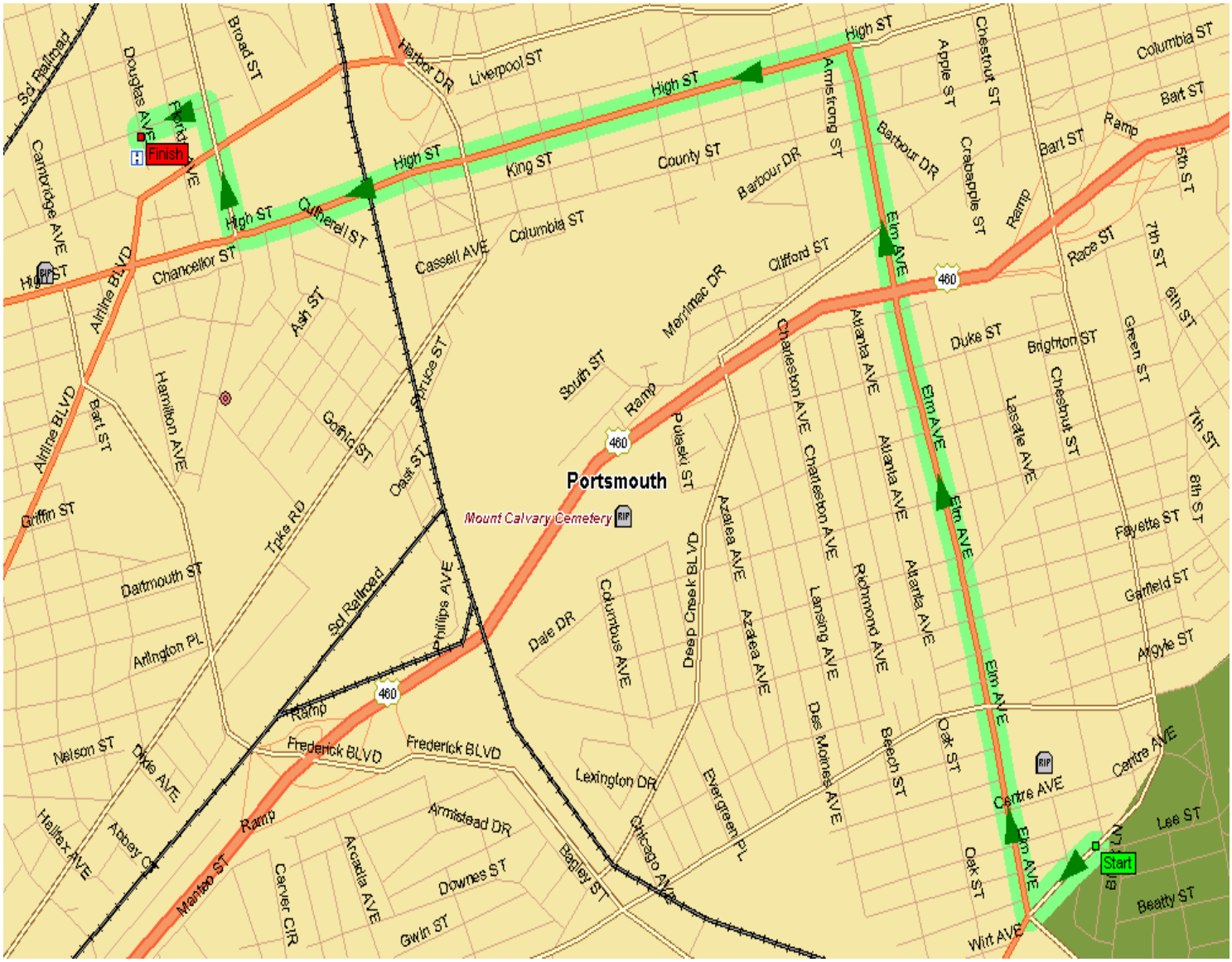
Hospital Name/Address: Mayview Medical Cneter
3636 High Street
Portsmouth, VA 23707

Hospital Phone #: 757-398-2200

Directions to Hospital

1. Leave main gate of Annex and take left onto Victory Blvd.
2. At route 17 (George Washington Hwy) take a right and go north.
3. Make left onto Fredrick Blvd, and continue on Fredrick until it dead ends.
4. Make left onto High Street, the Maryview Medical Center in on the right at the first light.

(Total distance about 4.5 miles).



Appendix C
UXO Work Plan

ORDNANCE EXPLOSIVES AVOIDANCE

BACKGROUND INVESTIGATION and SITE INVESTIGATION

For VARIOUS AREAS of CONCERN (AOC) and SITES at St. JULIENS CREEK

ANNEX

CHESAPEAKE, VA

APPENDIX A:
ORDNANCE/EXPLOSIVES AVOIDANCE
BACKGROUND INVESTIGATION and SITE INVESTIGATIONS for VARIOUS AERAS of CONCERN (AOC) and SITES at ST, JULIENS CREEK ANNEX
CHESAPEAKE, VA

A-1.0 INTRODUCTION

The purpose of this Site Specific Operating Procedure is to establish general guidelines and procedures that assure protection of CH2M Hill, Explosive Ordnance Technologies Inc. (EOTI) personnel and the public. This plan includes considerations unique to OE operations. EOTI is the Unexploded Ordnance (UXO) contractor and has consulted with CH2M Hill on the development of this plan.

The objective of a SSHP is to provide supervisors and workers with the necessary information and guidance to maintain a safe and healthy work place environment. CH2M Hill and EOTI view safety and accident prevention as the first priority and place the burden of responsibility on all employees, consultants, and contractor/subcontractor team members. A copy of this SSHP is available to all employees, subcontractors, and visitors. All supervisors and workers are required to read the SSHP and sign a log acknowledging that they understand the plan prior to entering the work site. Personnel that violate policies contained in the SSHP may be directed to leave the work site and, if appropriate, their employment may be terminated.

A-1. General. EOTI will augment CH2M Hill with Unexploded Ordnance (UXO) personnel to provide on-site UXO support during all sampling activities at the multiple Site Investigation and Background Investigation project sites identified in the attached scope of work (SOW). During site investigation activities, components of explosives were encountered in these areas. The EOTI UXO team will not move, touch or destroy any UXO encountered during this phase of the project. The UXO team will report all UXO to the CH2M Hill Supervisor, and local military Explosive Ordnance Disposal personnel. EOTI will safely locate, and identify any potential ordnance and ordnance related scrap hazards, found in the work area.

A-2. References

ETL 385-1-1 CEHNC Safety Concepts and Basic Considerations for Unexploded Ordnance Operations dated 7 March 2000. (See attachment A).

Draft ETL 385-1-2 CEHNC Interim Guidance Ordnance Avoidance during Geo-technical

Operations (August 1996)

EM 385-1-1 Safety Requirements and Health Manual (3 September 1996)

A-3. Definitions

a. Ordnance and Explosive (OE). Bombs and warheads, guided and ballistic missiles, artillery, rocket and mortar ammunition, small arms ammunition, anti-personnel and anti-tank mines, demolition charges, pyrotechnics, grenades, containerized and non-containerized explosives and propellants, military chemical agents and all similar and related items or components, explosive in nature or otherwise designed to cause damage to personnel or material. Soils with explosive constituents are considered to be OE if the concentration is sufficient to be reactive and present an imminent safety hazard.

b. Unexploded Ordnance (UXO). An item of explosive ordnance that has failed to function as designed or that has been abandoned, discarded or improperly disposed of and is still capable of functioning and causing damage to personnel or material.

c. Inert Ordnance. An item that has functioned as designed, leaving an inert carrier. An item manufactured to serve a specific training purpose. Fragments from UXO.

d. Explosive Ordnance Disposal (EOD) Personnel. Active duty military EOD personnel.

e. UXO Personnel. Former EOD personnel employed by a contractor.

f. Recovered Chemical Warfare Material (RCWM). RCWM is defined as chemical agent material and/or associated equipment and surrounding contaminated media discovered either by chance or during deliberate real estate recovery/restoration operations that was previously disposed of as waste. RCWM is classified as hazardous waste by the Army and not within the scope of the Army Chemical Surety Program.

g. Chemical Event. Discovery of an actual or suspected chemical agent or container that may require emergency transportation or disposal.

A-4. UXO Team Composition and Qualifications. The following UXO procedures are proposed for use at the St. Juliens, Creek Annex, Areas of Concern (AOC). Procedures used at the site will be followed until such time as the UXO supervisor and the CH2M Hill Supervisor deem the procedures unnecessary.

a. UXO Team Leader. The UXO Team Leader for this project is Mr. Carver Cobbins. Mr. Cobbins is qualified for this position by virtue of training and

experience. He has more than 15 years of military and civilian UXO experience. Mr. Cobbins is qualified for and has served as UXO Supervisor, Site Safety Officer, and Quality Control Specialist. Mr. Cobbins has attained Master EOD Technician level. Duties and assignments include range clearance as a supervisor of multiple team operations and civilian UXO experience including performance as UXO Supervisor for OE removal operations.

b. UXO Team Member. The UXO Team Member for this project is Mr. Harold Thompson. Mr. Thompson is a graduate of the U.S. Naval Explosive Ordnance School at Indian Head, Maryland. Mr. Thompson is a Senior Explosive Ordnance Disposal Technician with over 10 years of combined military and civilian experience.

A-5. Responsibilities and Authority. The Team Leader is the technical lead for all ordnance/explosives operations and is assigned the following safety and health related responsibilities:

- Reports administratively to the CH2M Hill Site Supervisor, coordinating schedule and support requirements through that individual;
- Overall coordination between operations and safety, and health personnel;
- Reviewing and becoming familiar with the site WP and SSHP; and
- Early detection and identification of potential problem areas, including safety and health matters,
- Conduct and document UXO safety briefings for all site personnel and visitors.

A-6. Work and Safety Plans.

UXO Specialists are required to comply with the provisions of the SSHP, WP, and all applicable Federal, State and local regulations. They report to their assigned UXO Supervisor for performing duties as member of functional teams. The UXO Team Leader will conduct UXO safety briefings for all site personnel and visitors.

A-7. Access Routes to Sampling Locations

a. Prior to soil sampling or well drilling crews entering the site, EOTI will conduct a reconnaissance of the sampling area for each of the sample or well locations. The reconnaissance will include locating a clear path for the sampling or drilling crews, vehicles and equipment to the approach site. The approach path, at a minimum will be twice the width of the widest vehicle (normally a minimum of 20'). EOTI will clearly mark all boundaries of the cleared approach path with pin flags or other suitable markers (normally yellow in color), to prevent personnel from straying into areas that have not been cleared. No personnel will be allowed outside the cleared paths.

b. If UXO is encountered on the surface, EOTI personnel will divert the approach path around the UXO, clearly mark the area with red pin flags or ribbon and

report the UXO.

c. A magnetometer will be used to insure there is no subsurface UXO within the approach path. If a magnetic anomaly is encountered, EOTI will divert the path around the anomaly. Only EOTI personnel will handle UXO and operate magnetometers.

A-8. Soil Sampling Sites.

a. The EOTI UXO team will locate magnetic anomaly free areas for soil samples unless a sample must be obtained from a pre-selected area. Pre-selected sampling areas will be surveyed with a magnetometer to insure that anomalies are not present. If a pre-selected area indicates magnetic anomalies, EOTI personnel will identify the anomaly. If the anomaly poses no threat or risk to personnel the sample will be obtained from the pre-selected area. If the anomaly is hazardous or poses a potential threat to personnel. A new sampling site will be chosen.

b. EOTI will clearly mark the boundaries of the soil-sampling site. Personnel will not go outside the cleared area. As a minimum, the cleared area will be a square, with a side dimension equal to twice the length of the largest vehicle or piece of equipment to be brought on site.

c. EOTI will use a handheld magnetometer to clear an area prior to sub-surface soil sampling or well drilling operations commencing. At not more than a two-foot depth, the magnetometer will be lowered into the soil-sampling hole. This procedure will be used to ensure that smaller items of UXO, undetectable from the surface can be detected. If no magnetic anomalies are located, the procedure will be repeated at two-foot intervals to the maximum depth of the sample to be taken.

d. The following personal protective clothing (PPE) will be used by all EOTI personnel while on the site.

- Safety glasses or goggles, gloves, and safety shoes.

NOTE: EOTI personnel will not wear steel-toed shoes or other ferrous items on their person because of their interference with the operation of magnetometer/ordnance locators.

e. The following ordnance locators will be used to support this operation:

- The Schonstedt Models GA-52 and GA-72 magnetic locators will be used for sweeping and sub-surface range clearance operations. These locators are designed to detect the magnetic field between two sensors spaced inside the locators 20" and 14" apart respectively.

NOTE: The primary disadvantage of these locators is their inability to respond to nonmagnetic materials such as gold, silver, copper, brass or aluminum; all of which can be found in certain types of military ordnance. Standard UXO safety precautions and techniques will be followed in support of this operation.

A-9. Recovered Chemical Warfare Materials (RCWM).

a. If suspected RCWM is located at any time, all work will cease immediately. Site workers will withdraw along cleared paths from the area containing the RCWM. The EOTI Team Leader will clearly mark the area containing the RCWM, and report the chemical event as specified in Figure A-1. EOTI UXO personnel will standby in an upwind location until relieved by a government representative. The report of discovery of suspected RCWM will be made within one hour of the discovery. The POC will make the final determination as to the actual presence of RCWM.

b. If the POC confirms the presence of RCWM, the government person in charge will report the chemical event to the appropriate agencies.

c. When contacting the POC about suspect RCWM, EOTI will provide the information listed in Figure A-1. Contact with the POC will not be delayed due to lack of information. The suspect RCWM report will follow the format in Figure A-1.

Figure A-1. Suspected RCWM Data Report
1. Date and local time of event.
2. Location
3. Quantity and type of munition(s) or container(s) and chemical agents involved.
4. Description of what has happened.
5. Description of property damage.
6. Personnel casualties and/or injuries.
7. Whether medical services or facilities were required.
8. Assistance required.
9. Any other pertinent information.

ATTACHMENT A
BASIC SAFETY CONCEPTS AND CONSIDERATIONS FOR ORDNANCE AND EXPLOSIVES OPERATIONS

TABLE OF CONTENTS

BASIC SAFETY CONCEPTS AND CONSIDERATIONS
FOR ORDNANCE AND EXPLOSIVES (OE) OPERATIONS

CHAPTER 1
INTRODUCTION

1-1. Purpose. This pamphlet establishes the safe operating procedures for dealing with ordnance and explosives (OE) and unexploded ordnance (UXO) items on formerly used defense sites (FUDS), base realignment and closure (BRAC) and installation restoration (IR) projects. Because there are no absolute safe procedures for dealing with OE, merely procedures considered being least dangerous, it is essential that a planned and systematic approach be established.

1-2. Applicability. This pamphlet applies to all Headquarters, United States Army Corps of Engineers (HQUSACE) elements, United States Army Corps of Engineers (USACE) commands, and their contractors having the responsibility for performing OE response activities. For the purpose of this document, all references to OE include UXO.

1-3. References. Required and related publications are listed in appendix A.

1-4. Distribution. Approved for public release; distribution is unlimited.

1-5. Policy. It is the policy of the USACE to produce products and services that fully meet the customers' expectations of quality, timeliness and cost effectiveness. All OE response procedures must be formulated to ensure harmony with the USACE Strategic Vision and should be in concert with activities presented in other USACE guidance. There should be no compromise of health and safety requirements to meet production or quality goals. Safety is the leading edge of quality.

1-6. Responsibilities. It is the responsibility of all USACE and contractor personnel involved with OE response projects to safely execute them in accordance with (IAW) the approved plan, (SSHP), Work Plan (WP), and all applicable laws, regulations, and policies.

1-7. Terms and Definitions.

a. Ordnance and Explosives. Ammunition, ammunition components, chemical or biological warfare materiel, or explosive that have been abandoned, expelled from demolition pits or burning pads, lost, discarded, buried or fired. Such ammunition components and explosives are no longer under accountable record control of any DOD organization or activity.

b. Explosive Soil. Explosive soil refers to a mixture of explosives in soil, sand, clay or other solid media at concentrations such that the mixture itself is explosive.

c. Unexploded Ordnance (UXO). Military Munitions that have been primed, fuzed, armed, or otherwise prepared for action, and have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to the operations, installations, personnel, or material, and remain unexploded either by malfunction, design, or any other cause.

d. UXO Qualified Personnel. The term UXO Qualified Personnel applies only to personnel meeting the requirements for the positions of UXO Technician II, UXO Technician III, UXO Safety Officer, UXO Quality Control Specialist, and the Senior UXO Supervisor.

e. OE Procedures. These procedures include, but are not limited to, the following actions preformed by a UXO qualified individual.

(1) Gaining access to (manual excavation) and identifying subsurface anomalies and assessing the condition of buried OE.

(2) Identifying and assessing the condition of surface OE.

(3) Recovery and final disposal of all OE.

f. OE Related procedures: These OE related procedures include, but are not limited to, the following and can be performed by a non-UXO qualified individual:

(1) Location and marking of subsurface anomalies.

(2) Location and marking of suspected surface OE.

(3) Transportation and storage of recovered OE.

(4) Utilizing earth-moving machinery (EMM). Earth-moving machinery may be used to excavate overburden within 12 inches of a suspected OE.

1-8. General Safety Concerns and Procedures.

a. OE operations will not be conducted until a complete plan for the site is prepared and approved. These plans will be based upon limiting exposure to the minimum number of personnel, for the minimum time, to the least amount of OE consistent with safe and efficient operations.

b. Only UXO qualified personnel will perform OE procedures. Non-UXO personnel may be utilized to perform certain OE related procedures when supervised by UXO qualified personnel, i.e., mag/flag operations and gaining access using heavy equipment. All personnel engaged in field operations will be thoroughly trained and capable of recognizing the specific hazards of the procedures being performed. To ensure that these procedures are performed to standards, all field personnel will be under the direct supervision of a UXO Technician III.

c. Personnel who will be handling OE items will not wear outer or inner garments having static electricity generating characteristics. Materials made of 100 percent polyester, nylon, silk and wool, are highly static producing. Refer to DA Pam 385-64 for more information regarding non-static producing clothing.

d. Prior to any action being performed on an ordnance item, all fuzing will be positively identified. This identification will consist of fuze type by function, condition (armed or unarmed), and the physical state/condition of the fuze, i.e., burned, broken, parts exposed/sheared etc.

CHAPTER 2
OE SAFETY PRECAUTIONS

2-1. OE Safety Precautions.

a. Every effort will be made to identify a suspect OE item. Under no circumstances will any OE be moved in an attempt to make a positive identification. The OE item will be visually examined for markings and other external features such as shape, size, and external fittings. If an unknown OE item is encountered, the on-site USACE representative will be notified immediately. If there is no USACE personnel on-site, the District or Design Center's OE Safety representative will be notified as soon as possible. If external research is required, it will be initiated by the U.S. Army Engineering and Support Center, Huntsville. The following are additional considerations for the safe handling of OE items.

(1) Projectiles containing Base Detonating (BD) fuzes are to be considered armed if the round is fired.

(2) Arming wires and pop-out pins on unarmed fuzes should be secured prior to any movement.

(3) Do not depress plungers, turn vanes, rotate spindles, levers, setting rings or other external fittings on OE items. Such actions may arm or activate the OE.

(4) Do not attempt to remove any fuze(s) from the OE. Do not dismantle or strip components from any OE items.

(5) UXO Personnel are not authorized to inert any OE items found on-site.

(6) OE /UXO items will not be taken from the site as souvenirs/training aids

(7) Civil War ordnance will treated as any other OE.

b. Prior to entering areas/ranges contaminated with Improved Conventional Munitions (ICM) an approved DA weaver must be obtained. The District and/or Design Center's OE Safety representative must be notified.

c. Anytime during site activities a suspected chemical munition (CWM) is encountered, all work will cease, workers will evacuate upwind. A minimum of two UXO qualified individuals will position themselves upwind as far as possible to prevent unauthorized personnel from accidental exposure. The on site USACE OE Safety Specialist will be notified immediately. If a USACE OE Safety Specialist is not present the PM will contact the District or Design Center's OE Safety representative. The area will be secured until properly relieved, i.e., active duty Explosive Ordnance Disposal (EOD) personnel, Technical Escort Unit (TEU) or local authority.

d. Avoid inhalation and skin contact with smoke, fumes, and vapors of explosives and other related hazardous materials.

e. Consider OE items, which may have been exposed to fire and detonation, as extremely hazardous. Chemical and physical changes may have occurred to the contents, which might render it more sensitive than its original state.

f. Do not rely on the color coding of OE for positive identification. Munitions having incomplete or improper color codes have been encountered.

g. Avoid approaching the forward area of an OE item until it can be determined whether or not the item contains a shaped charge. The explosive jet, which is formed during detonation, can be lethal at great distances. Assume that all shaped charge munitions contain a piezoelectric (PZ) fuzing system until identified. PZ fuzing is extremely sensitive. They can function at the slightest physical change and can remain hazardous for an indefinite period of time.

h. Approach an unfired rocket motor from the side at a 45-degree angle. Accidental ignition can cause a missile hazard and hot exhaust.

i. Do not expose unfired rocket motors to any Electromagnetic Radiation (EMR) sources.

j. Consider an emplaced landmine armed until proven otherwise. It may be intentionally booby-trapped to deceive.

(1) Many training mines contain spotting charges capable of inflicting serious injury.

(2) Exercise extreme care with wooden mines that have been buried for long periods of time. Certain soil conditions can cause the wood to deteriorate and any inadvertent movement or pressure may initiate the fuze.

k. Assume that practice OE contains a live charge until it can be determined otherwise. Expended pyrotechnic and practice devices can contain red or white phosphorus residue. Due to incomplete combustion, the phosphorous residue may re-ignite spontaneously if the crust is broken and exposed to air.

l. Do not approach a smoking white phosphorous (WP) munition. Burning WP may detonate the explosive burster charge at anytime.

m. Foreign ordnance was returned to the United States for exploitation and subsequent disposal. Every effort will be made to research the applicable documentation and publications prior to commencement of a project.

n. Anomaly Avoidance Operations. Anomaly Avoidance procedures are detailed in

- ETL 385-1-2, (Draft) Generic Scope of Work for Ordnance Avoidance Operations, August 1996, and
- Ordnance and Explosives (OE) Center of Expertise (CX) Interim Guidance Document 99-01, Unexploded Ordnance (UXO) Support for Other Activities, 5 February 1999.

CHAPTER 3
OE STORAGE

3-1. OE Storage. During OE projects, explosive storage falls into two categories, on-DOD installations and off-DOD installations.

a. On-DOD installations the provisions of DOD 6055.9 STD will be followed. Generally, the installation should have an explosive storage area that meets DOD standards. The permitting and compliance requirements are the responsibility of the installation. The compatibility of explosives found in Chapter 3, DOD 6055.9 STD will be followed. OE items waiting final disposition will not be stored with other explosives. Storage of commercial explosives require DOD hazard class storage compatibility group

b. In the event the installation does not have an existing storage facility, the provisions of paragraph c, in this section, will apply.

c. Off-DOD installations, the contractor will be responsible for the construction of a temporary explosive storage area. This temporary storage area will meet all local, state, and 27 CFR, Bureau of Alcohol Tobacco and Firearms (BATF) requirements and as much of DOD 6055.9 STD as is practical to implement. The establishment of a temporary explosive storage area must meet the following requirements.

(1) The area will, if possible, meet the inhabited building and public traffic route distances specified in DOD 6055.9 STD. If the distances are less than required by the DOD guidance, a proposed barricading plan to protect the public from accidental detonation must be submitted and approved by the Huntsville Center's Structures Branch.

(2) Magazines must meet the requirements of the BATF regulations, and each magazine must have a Net Explosive Weight (NEW) established for the explosives to be stored.

(3) Each magazine must be grounded as specified in NFPA 780 and must meet the inter magazine distances as define in the DOD guidance.

(4) A physical security survey will be conducted to determine if fencing or guards are required. This survey will be coordinated through local law enforcement agencies. Generally, a fence around the magazine is not needed IAW BATF regulations. However, it is the responsibility of the contractor for determining the degree of protection to prevent the theft of explosives and OE items.

(5) A fire plan for either on or off-installation explosive storage areas will be prepared and coordinated with the local fire department. All magazines will have placards IAW 27 CFR/ATF P 5400.7 or DOD 6055.9 STD.

CHAPTER 4
OE TRANSPORTATION

4-1. OE Transportation. In the event that OE items must be transported off-site, the provisions of 49 CFR, DA Pam 385-64 state and local laws will be followed. These additional considerations are provided for the safe transportation of OE items:

a. USACE contractors are prohibited from transporting OE off-site for destruction until the provisions of paragraph 1-9, TB 700-2 are followed.

b. Do not transport WP munitions unless they are immersed in water, mud or wet sand.

c. If loose pyrotechnic, tracer, flare or similar mixtures are to be transported, they will be placed in #10 mineral oil or equivalent to minimize the fire and explosion hazards.

d. Incendiary loaded munitions should be placed on a bed of sand and covered with sand to help control the burn if a fire should start.

e. If an unfired rocket motor must be transported, it will be positioned in the vehicle parallel to the rear axle. This will afford maximum protection for the personnel operating the vehicle.

f. If a base-ejection projectile must be transported to a disposal area, the base will be oriented in the vehicle so that it is parallel to the rear axle. This will afford maximum protection for the personnel operating the vehicle.

g. OE with exposed hazardous fillers such as High Explosive (HE), will be placed in appropriate containers with packing material to prevent migration of the hazardous fillers. Padding should be added to protect the exposed filler from heat, shock and friction.

CHAPTER 5
EXCLUSION ZONE OPERATIONS

5-1. Exclusion Zone Operations. On OE project sites, it is the responsibility of the contractor's UXO Safety Officer (UXOSO) to establish the exclusion zone for each UXO team. This exclusion zone should not be confused with the safe separation distance, which is maintained between teams.

a. The purpose of the exclusion zone is for the protection of non-essential project personnel and the public from blast overpressure and fragmentation hazards. There are two criteria for calculating exclusion zones;

(1) Intentional Detonations. When destroying ordnance, both the hazards from fragmentation and overpressure must be considered. The minimum separation distances in DOD 6055.9 STD will be used unless otherwise stated. The maximum fragmentation and overpressure distances may also be calculated IAW HNC-ED-CS-S-98-1, Methods for predicting Primary Fragmentation Characteristics of Cased Munitions.

(2) Unintentional Detonations. If the identification of OE on an OE site is unknown, the minimum separation distance specified in DOD 6055.9 STD, chapter 5, paragraph C5.5.4, will be used to establish the exclusion zones. When the identification of OE items are known, the exclusion zones will be determined by the U.S. Army Engineering and Support Center, Huntsville, (USAESCH) Engineering Directorate using HNC-ED-CS-S-98-1.

b. When multiple teams are working on site, a safe separation distance will be established. The minimum distance maintained between teams will never be less than 200 feet or the K50 overpressure distance. The one that is greater will be used.

c. While OE operations are being conducted, only personnel essential for the operation will be allowed in the exclusion zone. When non-essential personnel enter the exclusion zone, all OE operations will cease. In addition to this work stoppage, the following actions will be accomplished:

(1) The individual(s) must receive a safety briefing and sign the visitor's log prior to entering the zone.

(2) The individual(s) will be escorted by a UXO qualified individual.

(3) All OE operations will cease within the radius of the exclusion zone for the areas to be visited.

d. All personnel working within the exclusion zone will comply with the following:

(1) There will be no smoking within the exclusion zone, except in areas designated by the UXOSO.

(2) There will be no open fires for heating or cooking (gas stoves, grills etc.) within the exclusion zone, except where authorized by the UXOSO.

(3) During magnetometer operations, workers will have no metal parts in or on their shoes that would cause the magnetometer to present false indications.

CHAPTER 6
OE EXCAVATION OPERATIONS

6-1. OE Excavation Operations.

a. Hand excavation is the most reliable method for uncovering OE provided the item is near the surface. Hand excavation exposes personnel to the hazard of detonation for longer periods of time than any other method. Taking this into consideration, only UXO personnel will be used to accomplish this task.

b. Earth-Moving Machinery (EMM) may be used to excavate buried OE. EMM will not be used to excavate within 12 inches of a suspected OE. Once the EMM is within the 12 inches of the OE, the excavation will be completed by hand excavation methods. Personnel who are not UXO qualified can operate EMM only when supervised by a UXO Technician III.

(1) If more than one EMM is to be used on site, they will observe the same safe separation distances required for multiple work teams.

(2) During EMM excavation operations, only those personnel absolutely necessary for the operation will be within the exclusion zone.

(3) EMM operations will be conducted with the guidelines of EM 385-1-1 and 29 CFR 1926 subpart P.

c. Excavation operations, whether by hand or EMM will employ a step down or offset access method. Under no circumstances will any excavation be made directly over the suspected OE.

CHAPTER 7
OE DISPOSAL OPERATIONS

7-1. OE Disposal Operations. All demolition operations will be conducted IAW TM 60A 1-1-31 and the USAESCH Procedures for Demolition of Multiple Rounds on OE Sites. No other publications are to be used for these operations. Open burning of explosives, propellants, incendiary materials, and pyrotechnics is unauthorized.

a. As a general rule, all demolition operations will be accomplished by electrical means to assure maximum safety. There are exceptions to this requirement in situations where static electricity or Electromagnetic Radiation (EMR) hazards are present. Unintentional detonations can occur because of these induced currents (or lightning). The following precautions from TM 9-1375-213-12 are to be followed.

(1) Premature detonation of electric blasting caps by induced current from radio frequency (RF) signals is possible. Refer to TM 9-1375-214 that shows the minimum safe distance in respect to transmitter power and indicates distance beyond which it is safe to conduct electric blasting even under the most adverse conditions.

(2) Lightning is a hazard to both electric and non-electric blasting caps. A strike or a nearby miss is almost certain to initiate either type of cap or other sensitive explosive elements such as caps in delay detonators. Lightning strikes, even at distant locations, may cause extremely high local earth currents that may initiate electrical firing circuits. Effects of remote lightning strikes are multiplied by proximity to conducting elements, such as those found in buildings, fences, railroads, bridges, streams, and underground cables or conduits. The only safe procedure is to suspend all blasting activities during electrical storms and when one is impending.

(3) Electric power lines also pose a hazard for electric initiating systems. It is recommended that any demolition operation closer than 155 meters to electric power lines be done with a non-electric system such as NON-EL. This non-electric firing system provides the same amount of safety and control as electrical firing systems, but without the interference of EMR and static electricity hazards.

(4) Provisions of paragraph 1-9, TB 700-2 will be fully complied with prior to Corps contractors transporting OE off-site for destruction.

b. Personnel involved with demolition operations will not wear garments, which have static electricity generating characteristics. Materials such as polyester, nylon, silk or wool are highly static producing. No personnel handling demolition materials will wear any of these types of clothing. Refer to DA Pam 385-64 for more information regarding non-static producing clothing.

c. Only serviceable condition explosive material will be used for disposal operations.

d. The only acceptable disposal method is the one stated in the appropriate TM60 Series manual for specific ordnance types. Any commercial explosives being used will be equivalent to the military explosive required for the disposal operation.

NOTE

Oil well perforators/conventional shape charges are not acceptable substitutes for bulk explosives and will not be used for disposal operations except where applicable, refer to TM 60A-2-1-51. Otherwise these items are to be used only for the venting OE items prior to their turn-in as scrap.

e. If a situation dictates, protective measures to reduce shock, blast overpressure, and fragmentation will be taken. The USAESCH Engineering Directorate will assist in any design work and will review and approve all proposed protective works. As a minimum requirement all demolition shots will be tamped with clean earth or sand. IAW DOD 6055.9 STD the following separation distances will be observed unless otherwise directed by the Structures Branch.

(1) Minimum separation distance for non-fragmenting explosive materials will be no less than 1250 feet.

(2) Minimum separation distance for fragmenting explosive ordnance will be no less than 2500 feet. For bombs and projectiles with a diameter of 5 inches or greater, use a minimum distance of 4000 feet.

(3) Ordnance items with lifting lugs, strong backs, base plates, etc., will be oriented away from personnel, as fragments from these items tends to travel farther than normal.

f. Once demolition operations are completed, a thorough search of the demolition area will be conducted with a magnetometer to ensure a complete disposal was accomplished.

g. Inert ordnance will not be disposed of for scrap until the internal fillers/voids have been exposed and unconfined. Heat generated during the reclamation process can cause the inert fillers, moisture or air to expand and burst the sealed casings. In this situation, Oil Well Perforators can be used for venting these ordnance items which require demilitarization.

27 CFR 55	Alcohol, Tobacco Products and Firearms
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction
49 CFR 100-199	Hazardous Materials Transportation
DOD 6055.9 STD	DOD Ammunition and Explosive Safety Standards, August 1997
AR 190- 11	Physical Security
DA PAM 385-64	Ammunition and Explosive Safety Standards
TM 9-1375-213-12	Operators and Organizational Maintenance Manual; Demolition Materials,
TM 60A 1-1-22	EOD Procedures /General EOD Safety Procedures, April 1991
TM 60A 1-1-31	EOD Procedures/General Information on EOD Disposal Procedures, May 1994
EM 385-1-1	USACE Safety and Health Requirements Manual, September 1996
USAESCH	Procedures for Demolition of Multiple Rounds (consolidated shots) on Ordnance and Explosive Sites, August 1998.
ER 1110-1-8153	Ordnance and Explosives Response, 19 May 1998.
EP 1110-1-18	Ordnance and Explosives Response (Draft).
ATF P 5400.7	ATF Explosive Laws and Regulations, June 1990
HNC-ED-CS-S 98-1	Methods for Predicting Primary Fragmentation Characteristics of Cased Explosives, January 1998
HNC-ED-CS-S 98-2	Methods for Calculating Range to No More Than One Hazardous Fragment Per 600 Square Feet on OE Sites, January 1998
HNC-ED-CS-S 96-8	Guide Selection and Siting of Barricades for Selected OE, September 1997

Memorandum of Agreement, U.S. Army Engineering and Support Center, Huntsville, and Headquarters Forces Command, 52nd Ordnance Group, 18 July 1997.